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SUMMARY OF FIELD WORK, 1974

by the

GEOLOGICAL BRANCH

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ONTARIO
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AND MINES
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Edited by
V.G. Milne, D.F. Hewitt and K.D.Card

MISCELLANEOUS PAPER 59

1974

MINISTRY OF NATURAL RESOURCES

93-00933/

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Publications of the Ontario Division of Mines
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are obtainable through the
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Parliament Buildings, Queen's Park, Toronto, Ontario
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Parts of this publication may be quoted if credit is given to the Ontario Division of Mines. It is recommended that reference to this report be made in the following form for each individual author:

Feenstra, B.H.
1974: Quaternary Geology of the Grimsby Area, Southern Ontario; p.196-198 in Summary of Field Work, 1974, by the Geological Branch, edited by V.G. Milne, D.F. Hewitt, and K.D. Card, Ontario Div. Mines, MP59, 206p.

SUMMARY OF FIELD WORK, 1974

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ONTARIO DIVISION OF MINES

PREFACE

During the summer of 1974 the Geological Branch, Ontario Division of Mines, undertook 31 geological mapping projects, 2 geophysical survey projects and 3 geochemical survey projects. One contracted airborne magnetometer geophysical survey was completed in the fall of 1974. In all, 37 field projects were carried out, involving the services of 32 permanent geological staff: Precambrian Geology Section (17), Phanerozoic Geology Section (9), Geophysics/Geochemistry Section (4), and Resident Geologists (2); and 140 casual staff. Five permanent staff geologists of the Mineral Deposits Section were engaged in compilation and limited field examination of mineral deposits throughout the Province in 1974.

The locations of the areas investigated are shown on the map of the Province, at the beginning of this report. The preliminary results of the work are outlined in this summary, which contains reports prepared by leaders of each of the projects. In these reports, some emphasis has been placed on the economic aspects of the different investigations. It is the hope of the Geological Branch that the information thus provided will help in the mineral resource evaluation of these areas and so will be a valuable aid to mineral prospecting and resource planning in the Province.

Coloured maps and final detailed reports covering most of the field projects are being prepared for publication. In the interim, however, uncoloured preliminary geoscience maps with comprehensive marginal notes, will be released for distribution mostly during the winter of 1974-1975. These will mainly be published at the field scale of 1 inch to ¼ mile, 1 inch to 1 mile, or 1 inch to 2 miles. Notices of the releases will be mailed to all persons or organizations on the Ontario Division of Mines notification list, and will be published in the technical journals and other media.

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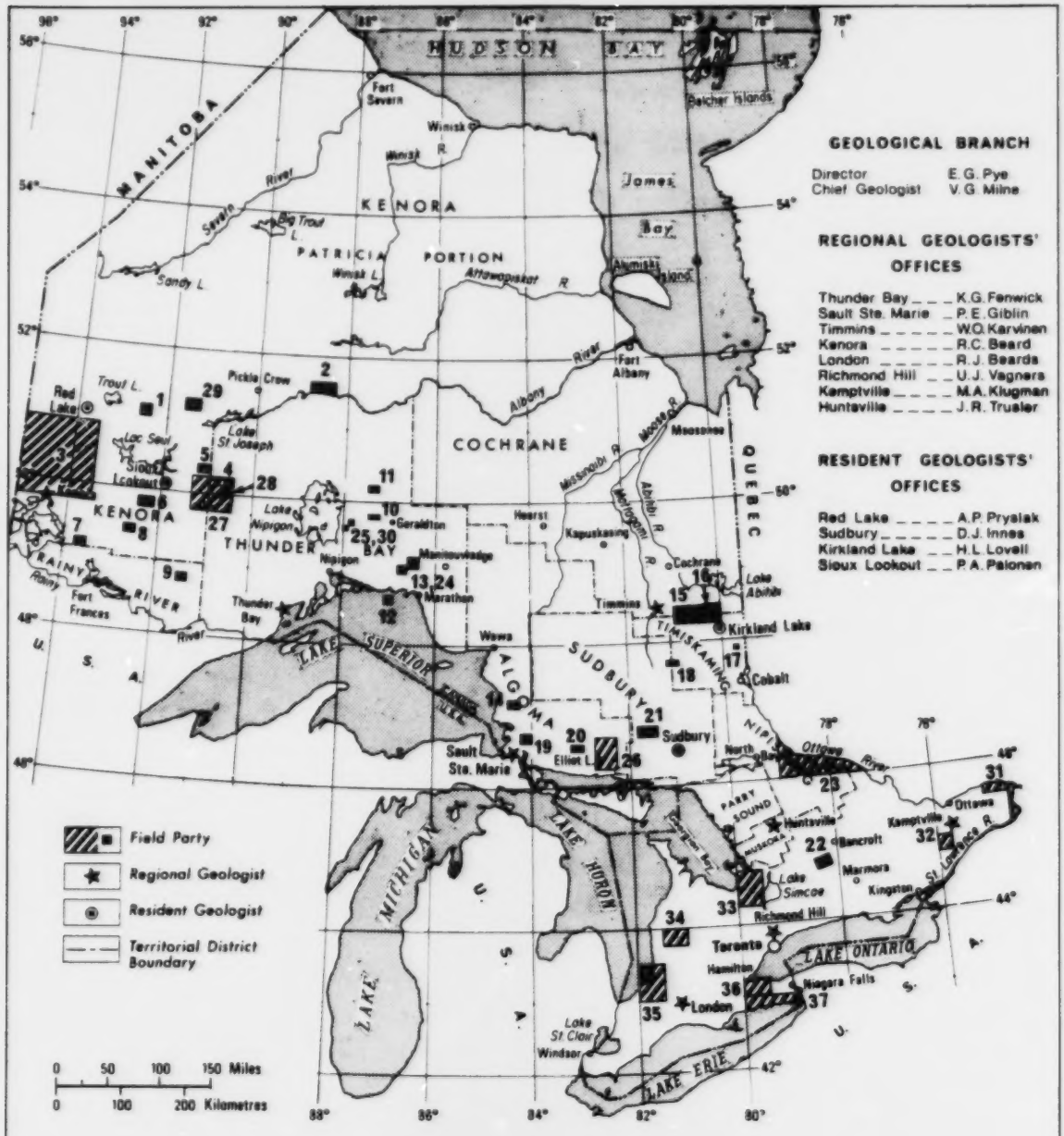

LOCATION OF FIELD PARTIES, 1974

GEOLOGICAL BRANCH
ONTARIO DIVISION OF MINES

ODM 4045 A

LIST OF FIELD PARTIES, 1974

No.	Location	Leader(s)
1.	Earngey-Costello Townships Area	P.C. Thurston
2.	Miminiska Lake Area	Henry Wallace
3.	Operation Kenora-Sydney Lake	F.W. Breaks W.D. Bond G.H. McWilliams C. Gower
4.	Sturgeon Lake-Chevrier Township Area	N.F. Trowell
5.	Farrington Lake Area	J.R. Trusler
6.	Sandybeach Lake Area	P.A. Palonen A.A. Speed
7.	Pipestone Lake Area	G.R. Edwards
8.	Boyer Lake Area	C.E. Blackburn
9.	Sapawe Lake Area	W.H. McIlwaine E.M. Hillary
10.	Lapierre and Hipel Townships	W.H. Mackasey
11.	Gledhill Lake Area	S.E. Amukun
12.	Slate Islands	R.P. Sage
13.	Carbonatite-Alkalic Complexes at Prairie Lake	R.P. Sage
14.	Batchawana-Pangis Area	G.M. Siragusa
15.	Watabeag River Area	D.R. Pyke
16.	Ramore Area	L.S. Jensen
17.	Bayly Township	H.L. Lovell
18.	Natal and Knight Townships	M.W. Carter
19.	Jarvis Lake-Garden River Area	Gerald Bennett
20.	Endikai Lake Area	K.M. Siemiatkowska
21.	Benny Area	K.D. Card D.G. Innes
22.	Cavendish and Anstruther Townships	E.G. Bright
23.	Mattawa-Deep River Area	S.B. Lumbers
24.	Geochemical and Quaternary Geological Studies of Carbonatite-Alkalic Complexes at Prairie Lake and Killala Lake	L.G. Closs E.V. Sado
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27.	Gravity Survey of the Sturgeon Lake Area	R.B. Barlow
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30.	Quaternary Geological Studies within the Beardmore-Geraldton Area	E.V. Sado
31.	Quaternary Geology of the Hawkesbury, Huntingdon, Lachute, and Vaudreuil Areas	Q.H.J. Gwyn J.J.L. Thibault
32.	Quaternary Geology of the Merrickville Area	D.R. Sharpe
33.	Quaternary Geology of the Barrie and Orr Lake Areas	G.J. Burwasser
34.	Quaternary Geology of the Wingham and Lucknow Areas	W.R. Cowan
35.	Quaternary Geology of the Grand Bend and Parkhill Areas	A.J. Cooper
36.	Quaternary Geology of the Grimsby Area	B.H. Feenstra
37.	Paleozoic Geology of the Fort Erie, Welland, and Dunnville Areas	P.G. Telford

Precambrian Geology Section

PRECAMBRIAN GEOLOGY SECTION SURVEYS, 1974

by

V.G. Milne[1]

Staff of the Section carried out 21 geological field mapping projects in the Precambrian Shield area of Ontario. In addition, two Resident Geologists conducted field mapping during part of the summer. Of these projects: field work was completed on 10 detailed, 1 inch to ½ mile scale, projects covering between 72 and 100 square miles (186 and 260 km^2) each; other detailed projects were started and will continue into 1975; 2 regional compilation projects at a scale of 1 inch to 1 mile were completed covering from 400 to 500 square miles (1036 to 1295 km^2) each and one covering about 400 square miles (1036 km^2) will continue into 1975; Operation Kenora-Sydney Lake, a regional helicopter reconnaissance project covering approximately 7,000 square miles (18000 km^2) was also completed in 1974. In total about 9,150 square miles (23700 km^2) were mapped.

The summaries appended represent rapid syntheses of geological field data as do the Preliminary Maps which are in preparation for publication during the winter of 1974-1975. These field reports and maps are designed as a means of rapidly disseminating highlights and general outlines of new information. More extended analysis of field data in conjunction with detailed office and laboratory research for final report and map publication can be expected to result in changes to the field terminology, interpretations, and concepts expressed.

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[1]Chief Geologist and Chief Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

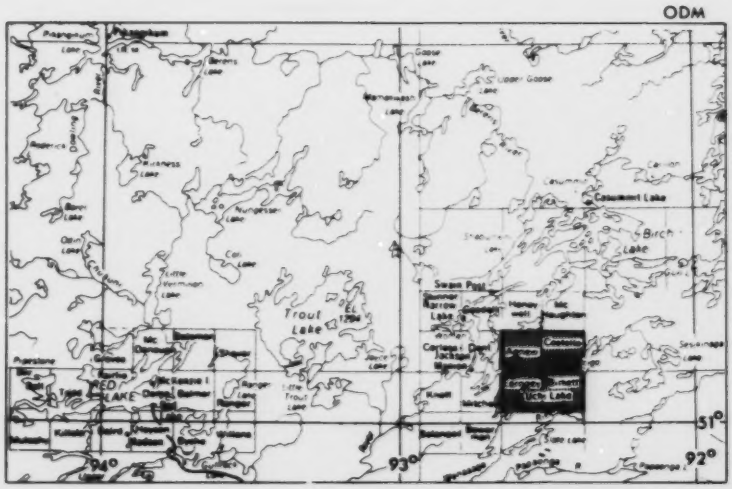
No.1 EARNGEY-COSTELLO TOWNSHIPS AREA

DISTRICT OF KENORA, PATRICIA PORTION

by

P.C. Thurston[1]

LOCATION: The map-area lies 55 miles (89 km) east of Red Lake and includes the Townships of Earngey, Birkett, Agnew and Costello. The portion of the area mapped this season lies east of Dent Township (Pryslak 1970) and north



LOCATION MAP Scale: 1 inch to 25 miles

of the area mapped by the author last year (Thurston et al. 1974). Confederation Lake may be reached via the road to the South Bay mine commencing at Ear Falls.

MINERAL EXPLORATION: Parts of Agnew Township were staked during the gold exploration rush in 1926 and 1927. This period of activity resulted in work on the Bobjo prospect described by Bruce (1928, p.40,47, reported by Thurston 1973, p.8,9). Bruce (1928, p.48) described the geology of three groups of claims "in the vicinity of Lost Bay", however, no mineralization was described, and the description does not precisely locate the claims.

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[1]Northern Archean Subsection Leader, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

The Hill-Sloan-Tivy vein was staked and developed at about the same time and was reported by Bruce (1928, p.48,49), Bateman (1939, p.43), and Thomson (1938, p.79). This occurrence is also described by Thurston (1973, p.13,14).

There is no further record of staking activity until the rush of 1969-70 associated with the discovery of base-metal mineralization at the South Bay mine in Dent Township by Selco Mining Corporation Limited. During the period 1969-70, the following exploration activity was recorded. Only three of the claims mentioned below are presently in good standing; they are leased to Selco Mining Corporation Limited.

Within the central and southwestern part of Agnew Township, 183 claims, owned by Selco Mining Corporation Limited, were covered by airborne electromagnetic and magnetic surveys, and ground geophysical surveys, followed by diamond drilling as follows: (a) on the grid west of Lost Bay four holes totalling 1,478 feet (451 m), (b) on a small grid halfway between Perrigo Lake and Lost Bay just north of the Earngey-Agnew Township line, a single hole 339 feet (103 m) deep and, (c) adjacent to the west shore of Perrigo Lake a single 360 feet (110 m) hole (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake).

New Hosco Mines Limited staked a group of 107 claims in eastern Agnew and western Costello Townships. Airborne electromagnetic and magnetic surveys were carried out over the claim groups, and the results filed[1] with the Assessment Files Research Office, Ontario Division of Mines, Toronto. No follow-up ground geophysical work or diamond drilling is on file.

The M.J. Boylen interests owned one group of 24 claims, one group of 8 claims and one group of 6 claims in northwest Agnew Township. Airborne electromagnetic and magnetic surveys were conducted and are on file. No follow-up work has been filed.

Dome Exploration (Canada) Limited owned a group of 16 claims in northwest Agnew Township for which they have filed airborne electromagnetic and magnetic surveys. No follow-up work is on file.

Noranda Exploration Company Limited carried out ground electromagnetic and magnetic surveys on a group of 21 claims, 16 of which are in Agnew Township at about the midpoint of the Dent-Agnew Township boundary. No follow-up work is on file.

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[1]All files mentioned in the following paragraphs are available at the Assessment Files Research Office, Ontario Division of Mines, Toronto.

Nudulama Mines Limited had a group of 24 claims in north-central Agnew Township, upon which they carried out airborne electromagnetic and magnetic surveys. No follow-up work is on file.

New Harricana Mines Limited held a group of 18 claims just north of the Nudulama Mines Limited group. Airborne electromagnetic and magnetic surveys are on file for this group, but no follow-up work has been filed.

Satellite Metal Mines Limited held a block of 24 claims in north-central Agnew Township upon which they carried out airborne electromagnetic and magnetic surveys; no follow-up work has been filed.

Grandroy Mines Limited held a block of 14 claims of which two fall in Agnew Township along the north boundary. Airborne electromagnetic and magnetic surveys are on file. No follow-up work is on file.

The J.P. Sheridan interests held a block of 107 claims in Agnew and Costello Townships. Airborne electromagnetic and magnetic surveys are on file for this group, but no follow-up work has been filed.

Midland Nickel Corporation Limited held a block of 56 claims in Agnew Township upon which they conducted airborne electromagnetic and magnetic surveys. No follow-up on the anomalies is known to have been done.

Copperville Mining Corporation Limited held 30 claims in south-central Agnew Township upon which ground electromagnetic and magnetic surveys were performed, with no anomalies disclosed.

Colleen Copper Mines Limited held a group of 20 claims in south-central Agnew Township upon which ground electromagnetic and magnetic surveys were conducted. The surveys only partially covered the claim group, and no important anomalies were disclosed.

C.C. Huston and Associates held one group of 50 claims east of Perrigo Lake and a group of 9 claims north of Perrigo Lake. An airborne magnetic survey was flown covering the whole of Costello Township. However, no follow-up work is known to have been done.

GENERAL GEOLOGY: The map-area lies in the southeastern part of the Birch-Uchi Lakes metavolcanic-metasedimentary belt, within the Uchi Subprovince (Ayres et al. 1971).

The work done this season gives a cross-section of the east side of the N- to NNE-trending synclinorium which is the major fold of the belt. Proceeding from east to west, the rock types encountered are: (1) greywacke-arkose units with occasional conglomerate lenses in the Slate Lake sediments (Bateman 1939); (2) a unit of mafic flows and clastic rocks; and (3) the northward extension of the intermediate to felsic, reworked-pyroclastic unit reported by Thurston (1973). These units are followed by a second volcanic cycle (4) consisting of mafic and intermediate flows, minor intermediate pyroclastic rocks, and felsic pyroclastic rocks with minor felsic flows.

The lowermost unit (1), the Slate Lake metasediments, underlies the eastern two-thirds of Birkett Township and extends along strike northwards, underlying the eastern portion of Costello Township. The unit consists of interbedded arkose and greywacke, with a few conglomeratic lenses in the northern portion. The mafic flows (2), to the west, which overlie the metasediments, consist of pillowed flows with interbedded pillow breccia and associated minor amounts of metasediments and pyroclastic rocks. The pyroclastic rocks (3), overlying the mafic flows consist of intermediate tuff, lapilli-tuff and tuff-breccia. These rocks exhibit evidence of reworking such as slightly rounded fragments, some evidence of sorting, and thick-bedded units. Interbedded with the intermediate pyroclastic rocks are thinner (less than 1,000 feet) units of felsic tuff, and occasional felsic flows.

The second volcanic cycle (4), termed by Goodwin (1967) the "upper basic" volcanic rocks, consist of a mafic to felsic cycle. The mafic metavolcanics occur along the east shore of and within Lost Bay of Confederation Lake. They are succeeded stratigraphically upwards by intermediate spherulitic flows, felsic spherulitic flows and pyroclastic rocks, which extend westward to the west boundary of Agnew Township at the south end of the Township. Further north in Agnew Township, an additional sequence is exposed because the regional strike is slightly east of north. This unit consists of very fine-grained to aphanitic, intermediate flows and tuffs. These rocks appear mafic in the field, but preliminary petrographic data indicate they are intermediate.

The volcanic sequence is cut by a mass of porphyritic, chloritic, sericitic, and granophyric granodiorite which extends from just northeast of the narrows of Confederation Lake to the area of Found Lake, a distance of 3.75 miles (6 km). The granodiorite is locally mantled by thin discontinuous pockets of quartz-feldspar porphyry which is, to the west, the host rock for the orebody at the South Bay mine. This suite of intrusive rocks is cut by granitic rocks of the Okanse Lake pluton.

Granitic rocks form composite plutons along the east boundary of Costello Township, and the east boundary of Birkett Township, and in the area west of Costello Lake, the Perrigo Lake area, and the Okanse Lake area.

All except the body along the east boundary of Birkett Township consist of hornblende diorite to hornblende-biotite quartz monzonite. Porphyritic dioritic phases appear to be concentrated at the margins of the bodies. The pluton extending from the Wenasaga River to the east boundary of Birkett Township comprises lenses of porphyritic pegmatitic biotite-muscovite granite with varying amounts of agmatitic inclusions of metagreywacke.

STRUCTURAL GEOLOGY: The Birch-Uchi Lakes metavolcanic-metasedimentary belt is isoclinally folded about north-south trending axes, and is part of a regional synclinorium proposed by Goodwin (1967). The major fold axis probably crosses the northwest corner of Agnew Township where opposing pillow tops were observed.

Very few primary structures useful for top determination were found. Pillowed mafic flows north and east of Lost Bay consistently gave west-facing tops. However, the continuation northward of the stratigraphy shown on Map P.932 (Thurston et al. 1974) (Earngey and part of Birkett Townships) would indicate that at least some of the folds persist as far north as the drift covered area east and south of Agnew Lake. The syncline centred on the intermediate, pyroclastic rocks east of the Uchi mine on Map P.932 (Thurston et al. 1974) continues northward through Agnew Township as far as Philchub Lake. West of this, the anticline just west of the Uchi Mine is traceable with difficulty to the southwest corner of Agnew Lake. West of this anticlinal axis, all top determinations indicate a west-facing sequence forming the east limb of the regional synclinorium. The anticline centred on Wabanook Bay of Uchi Lake is traceable with difficulty to the west shore of Perrigo Lake. No facing data is available north of Perrigo Lake.

ECONOMIC GEOLOGY:

Gold: Detailed mapping and sampling by the field party of the Hill-Sloan-Tivy vein on the Grasett property (Thomson 1938, p.81), the old Tremblay property (Thomson 1938, p.82), and to the south, the Conwo Gold Mines Limited property (Thomson 1938, p.78, 79) was completed this field season (see also Thurston 1973). Sampling of the Hill-Sloan-Tivy vein gave the following results (assays by the Mineral Research Branch, Ontario Division of Mines):

Sample No.	Au oz/ton	Ag oz/ton
DB Bulk 1 East*	0.05	Trace
2 East	0.01	Trace
3 East	0.02	Trace
1 West	0.03	0.29
2 West	Trace	Trace
3 West	1.26	0.27

Sample No.	Au oz/ton	Ag oz/ton
1 Middle	0.84	0.18
2 Middle	0.01	Trace
3 Middle	0.38	0.35
DE Chan 1**	0.14	0.14
2	0.19	0.26
3	0.96	0.23

*All samples in this series are grab samples
**Channel samples the full width of the vein

Base Metals: Selco Mining Corporation Limited drilled a series of five holes in the interbanded pyroclastics and metasediments halfway between Lost Bay and Perrigo Lake. One hole UO-6, 339 feet (103 m) long, lies within Agnew Township and cuts sparsely mineralized intermediate lapilli-tuff (Assessment Files Research Office, Ontario Division of Mines, Toronto). Samples examined by the author contained only sparse amounts of pyrrhotite and pyrite.

The "Crab" grid of Selco Mining Corporation Limited along the west shore of Lost Bay has a total of four holes drilled for which logs were made available to the author by the company.

The four holes encountered minor amounts of pyrite and pyrrhotite in narrow shear zones and disseminations in mafic flows and/or intermediate pyroclastic rocks. The work of Selco Mining Corporation Limited indicates that the geophysically anomalous areas in the granodiorite and bordering the metavolcanics are not promising.

A rusty zone up to 12 feet (3.6 m) wide by 30 feet(9 m) long containing coarse, heavily sheared, and altered, intermediate to felsic pyroclastic rocks, occurs north of Perrigo Lake on the south shore of a small lake which is elongated east-west. Samples taken by the author's assistants gave low assay results (a maximum of 0.32 percent Zn and less than 0.1 percent Cu).

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Thurston, P.C., Raudsepp, M., and Wilson, B.C.
1974: Earngey Township and Part of Birkett Township, District of Kenora (Patricia Portion); Ontario Div. Mines, Prelim. Map P.932, Geol. Ser., scale 1 inch to ¼ mile. Geology 1973.

No.2 MIMINISKA LAKE AREA

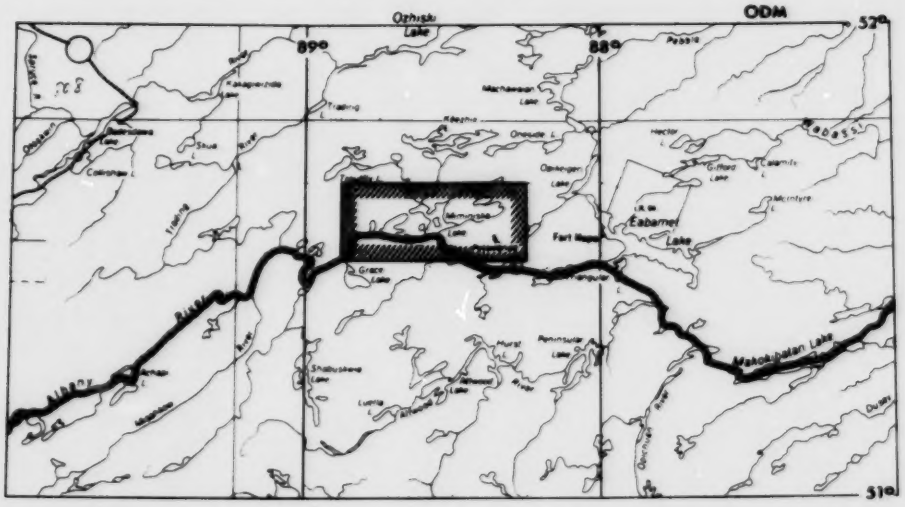
DISTRICTS OF KENORA, PATRICIA PORTION

AND THUNDER BAY

by

Henry Wallace[1]

INTRODUCTION: The Mimininska Lake map-area is a rectangle of approximately 310 square miles (803 km^2) bounded by Latitudes 51°30'N to 51°40'N and Longitudes 88°15'W to 88°53'W. Mimininska Lake, which is part of the Albany



LOCATION MAP Scale: 1 inch to 25 miles

River system, is located about 90 miles (145 km) north of Lake Nipigon and 65 miles (105 km) east of Pickle Lake.

During the 1974 field season roughly 60 percent of this map-area, most of that part east of Mimininska Peninsula, was mapped at a scale of 1 inch to ¼ mile (1:15,840). A small area around the Lilypad Lakes was mapped in 1973 (Wallace 1974). Completion of the mapping program is expected in 1975.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Toronto.

Convenient access is restricted to float-equipped aircraft which are available for charter from Armstrong, Pickle Lake and Nakina. For the last two summers light aircraft have been based at Mimininska Lodge, a tourist establishment northwest of Mimininska Island.

MINERAL EXPLORATION: The first prospecting in this region was done in the late 1920s after the discovery of gold northwest of Fort Hope in 1927. Minor staking occurred within the map-area but no significant exploration work was attempted at that time. Following up the gold discoveries, Burwash (1929) mapped part of the present map-area on a reconnaissance scale in 1928. He first recognized the potential iron ore deposits in the eastern part of Mimininska Lake which were not evaluated until the 1960s.

Sporadic gold exploration has continued in the area up to the present. In 1937 Prest (1939) reported diamond drilling south of Keezhik Creek in gold-bearing quartz veins and sulphide occurrences. In 1940, after a gold discovery at Goss Lake, a staking rush occurred between Mimininska and Opikeigen Lakes (Prest 1942). Considerable trenching and diamond drilling was carried out by Connell Mining and Exploration Company, Limited south and southeast of Goss Lake, and at the same time by Coin Lake Gold Mines, Limited south of Wottam Lake (Prest 1942).

In 1945, work continued in the area with active exploration on ground held by several companies between Frond Lake and Mimininska Peninsula. Connell Mining and Exploration Company, Limited ran a dip-needle survey over and prepared a geological map of their Goss Lake property (Assessment Files Research Office, Ontario Division of Mines, Toronto). The International Mining Corporation (Canada) Limited conducted a magnetometer survey over a large block of claims north of Wottam Lake, and drilled 6 diamond drill holes totalling 699 feet (213 m) (Assessment Files Research Office, Ontario Division of Mines, Toronto). Drilling and surface exploration work was carried out by Conwest Exploration Company Limited and Central Patricia Gold Mines Limited between Wottam Lake and Mimininska Island (Assessment Files Research Office, Ontario Division of Mines, Toronto).

More recently, most of the exploration work in the map-area has been directed toward locating base metal sulphide occurrences within metavolcanics and iron formation units, and toward the evaluation of potential sources of iron ore. Boylen Engineering Offices in 1960 performed ground electromagnetic and magnetometer surveys south of Keezhik Creek (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Both The Algoma Steel Corporation Limited and Mattagami Mining Company Limited conducted magnetometer surveys in 1965 over concentrations of iron formation northeast of Mimininska Peninsula and on the mainland east of Mimininska Island. Four diamond drill holes totalling 2,942 feet (897 m) were subsequently put down by Mattagami Mining Company Limited in 1966 but no further work on the occurrence has been reported (Assessment Files Research Office,

Ontario Division of Mines, Toronto). In 1972, Conwest Exploration Company Limited conducted electromagnetic and magnetometer surveys northwest of Frond Lake. A number of conductive zones were located but no follow up work was reported (Assessment Files Research Office, Ontario Division of Mines, Toronto). Also in 1972, a single 185-foot (56.4 m) diamond drill hole was put down by the Canadian Nickel Company Limited on the east shore of Miminiska Peninsula. The hole intersected disseminated sulphide mineralization in mafic and felsic metavolcanics (Assessment Files Research Office, Ontario Division of Mines, Toronto).

GENERAL GEOLOGY: Parts of the area around Miminiska Lake were examined by Bell (1886) and later by Burwash (1929). The first detailed geological mapping was done by Prest (1939, 1942) and most recently the area was included in a helicopter supported reconnaissance survey by Thurston and Carter (1970).

The map-area is underlain almost entirely by Early Precambrian (Archean) metasediments and metavolcanics of the Uchi Belt[1] (Goodwin 1968). The dominant feature is a folded, repetitious greywacke-argillite sequence extending from Frond Lake in the east, through the northern part of Miminiska Lake, to Howells Lake in the west. To the southeast, around Mezhisk and Frond Lakes, these metasediments grade into gneissic and granitoid rocks of quartz monzonitic composition. To the south the greywacke-argillite sequence is in fault (?) contact with metavolcanics which underlie the southern half of Miminiska Peninsula, the south shore of Miminiska Lake and the area surrounding Petawanga Lake. North of the metasediments there are more metavolcanics but their mutual contact is poorly defined particularly between Seagreen Lake and Keezhik Creek.

The metasediments consist predominantly of thin monotonously interbedded units of lithic and feldspathic greywackes and argillite and their metamorphosed equivalents. Much less common in the sequence are units of arkose, quartzite (?) and conglomerate. Iron formation and related exhalogenic rocks are abundant in the eastern and central parts of the area intercalated with the other metasediments. Oxide facies (quartz-magnetite Algoma-type iron formation (Gross 1965) and banded chert), carbonate facies (iron-rich amphibole±garnet±biotite rocks), sulphide facies (pyrrhotite-bearing graphitic schist) and silicate facies (banded grunerite-hornblende rock), all occur within the map-area. Although quartz-magnetite iron formation is by far the most abundant, suspected carbonate facies rocks appear widespread. Oxide, carbonate and silicate facies rocks are found intimately associated in one locality south of Goss Lake, and the association of oxide and carbonate facies rocks is common.

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[1] A subprovince of the Superior Province.

In the eastern part of Mimimiska Lake, sedimentary aspects of the clastic rocks are well preserved. Such features as graded bedding, load casts and flame structures are very common. However, in the area between Wottam and Frond Lakes the metamorphic grade appears considerably higher. Phyllitic rocks, still recognizably epiclastic in origin, occur along the axis of the metasedimentary sequence which passes through Wottam and Goss Lakes. To the north and south of the axis the rocks change gradationally into interlayered slate and quartz-feldspar-biotite schist, and with further increase in the metamorphic grade into staurolite- and garnet-bearing schists.

The metavolcanics south of the metasediments are predominantly mafic flows with subordinate mafic to intermediate pyroclastic rocks. Pillows, facing northward, are well developed on Petawanga Lake and to a lesser extent on Mimimiska Lake where massive flows, now amphibolites and garnetiferous amphibolites, are more common. Felsic rocks appear to be rare except in the vicinity of Gumuly Lake and on the north shore of Petawanga Lake.

Those metavolcanics north of Wottam and Goss Lakes are mostly amphibolites, but north of the mouth of Ferguson Creek only felsic and intermediate pyroclastic rocks intercalated with arenaceous feldspathic metasediments are exposed.

Intrusive rocks, apart from the gneissic-granitoid body south of Frond and Mezhisk Lakes, underlie only minor parts of the area. Diabase-gabbro sills are abundant around Petawanga Lake. Such intrusions are uncommon within the metasediments but one large sill-like body of gabbro outcrops on the south side of Curry Bay. Pegmatite and quartz-feldspar porphyry sills and dikes cut all previously described rock types but are uncommon in most parts of the map-area. Wide, north- and northeast-trending, diabase dikes crossing the map-area through Wottam Lake and Mimimiska Island are believed to be of Late Precambrian age.

STRUCTURAL GEOLOGY: The major structural feature in the area, as suggested by aeromagnetic data (ODM-GSC 1960a,b), is a tight east-trending fold with its axial trace extending from north of Goss and Wottam Lakes, passing north of Mimimiska Island, to the northern part of Mimimiska Peninsula. Top determinations from metasediments on the southern limb indicate that the fold is a syncline. Near the nose of the major syncline, in the Frond Lake-Goss Lake area, most minor folds plunge westward at 15 to 25 degrees, while in the Wottam Lake area such folds are predominantly east-plunging. This apparent undulation in the fold axes suggests cross-folding of the major structure.

Foliation within metasediments and metavolcanics parallels the general east-west structural trend in most places. Conjugate sets of closely spaced joints and crenulation cleavages are commonly developed symmetrically about the axial planes of minor folds.

Two sub-parallel northeast-trending faults proposed separately by Prest (1939) and Thurston and Carter (1970) flank a block about 1 mile (1.6 km) wide extending along the south side of Ferguson Creek to the north of Mimiiska Island. Downward movement of this block relative to the surrounding rock explains the displacement of aeromagnetic patterns at the mouth of Ferguson Creek and north of Mimiiska Island.

The fault zone proposed by Prest (1939) separating metavolcanics on the southern part of Mimiiska Peninsula from metasediments to the north, is not obvious from aeromagnetic data (ODM-GSC 1960a,b). However, marked differences in metamorphic grade and dip between the two sequences tend to support the inferred structural "break".

Minor east- to northeast-trending faults and shear zones with displacements of a few inches to several feet are common in the metasedimentary sequence.

ECONOMIC GEOLOGY:

Iron: An extensive Algoma-type iron formation (Gross 1965), magnetite deposit is located within the metasedimentary sequence between Curry Bay and Wottam Lake where the iron formation has been markedly thickened by folding. In the few localities where the iron formation is exposed, it consists of finely laminated magnetite-quartz (metamorphosed chert) units and clastic metasediment units interbedded in roughly equal proportions, with individual units ranging between a few centimetres (1 inch) and 4 feet (1.2 m) thick.

The deposit, which was first outlined by its associated aeromagnetic anomalies (more than 73,000 gammas), has been described by Shklanka (1968, p.226) and Thurston and Carter (1970, p.55) based mainly on reports by Mattagami Mining Company Limited and The Algoma Steel Corporation Limited who performed ground magnetometer surveys there in 1965 (Assessment Files Research Office, Ontario Division of Mines, Toronto). These surveys located three anomalously high zones 5,200 feet (1585 m), 6,200 feet (1890 m) and 13,000 feet (3962 m) long on the peninsula northwest of Mimiiska Island, and numerous en echelon zones up to 2,000 feet (610 m) long in the area north of Mimiiska Island and the adjacent mainland to the east (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1966, two holes were diamond drilled in both localities by Mattagami Mining Company Limited to evaluate the iron content of the deposit. One of the two diamond drill holes on the peninsula northwest of Mimiiska Island intersected 507 feet (155 m) of interbedded iron formation and greywacke. Sections of the core were analyzed and found to contain 18.16 to 32.6 percent Fe, and magnetically separated concentrates derived after crushing to -325 mesh graded between 59.64 and 66.11 percent Fe. One of the two drill holes on the mainland intersected 540 feet (165 m) of iron formation, analyzed

sections of which contained between 13.03 to 30.03 percent Fe and yielded concentrates after crushing to -325 mesh ranging from 64.58 to 70.41 percent Fe (Shklanka 1968).

In other parts of the map-area, oxide facies iron formation units appear discontinuous and are generally only 10 to 20 feet (3 to 6 m) thick. Metamorphosed carbonate facies iron formation (now consisting almost entirely of silicate minerals) and silicate facies iron formation best developed south of Wottam and Goss Lakes are not significant as potential sources of iron ore.

Gold: Although minor amounts of gold have been found in several places within the map-area, (Prest 1939; 1942), no production has ever been reported. Exploration for gold, which has been concentrated between Miminiska Peninsula and Frond Lake, has indicated that it is associated with arsenopyrite and other sulphides in and near shear zones and quartz veins within areas of iron formation. Metamorphosed carbonate facies rocks appear to be a particularly favourable environment. A number of old gold workings south of Goss and Wottam Lakes and northwest of Wottam Lake occur within those rocks.

Sulphide Minerals: Lightly disseminated pyrrhotite and chalcopyrite, and small pods of pyrite, chalcopyrite, pyrrhotite and malachite are quite common in and between mafic and felsic pyroclastic units along the north shore of Petawanga Lake west of Gumuly Lake. No exploration work has been reported in this area.

On the east shore of Miminiska Lake just south of the inferred metasedimentary-metavolcanic contact, pyrrhotite and pyrite along with minor chalcopyrite occur disseminated and as stringers in felsic fragmental rock and a sheared graphitic rock which is probably sulphide facies iron formation. In 1972, a single diamond drill hole by Canadian Nickel Company Limited intersected this mineralized zone. In one felsic fragmental unit, 17 percent pyrrhotite occurred over a core length of 5.9 feet (1.8 m), but no chalcopyrite was reported (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Minor amounts of disseminated pyrite, pyrrhotite, arsenopyrite and chalcopyrite, and small pods of massive pyrrhotite and arsenopyrite commonly occur in and near oxide and carbonate facies iron formation.

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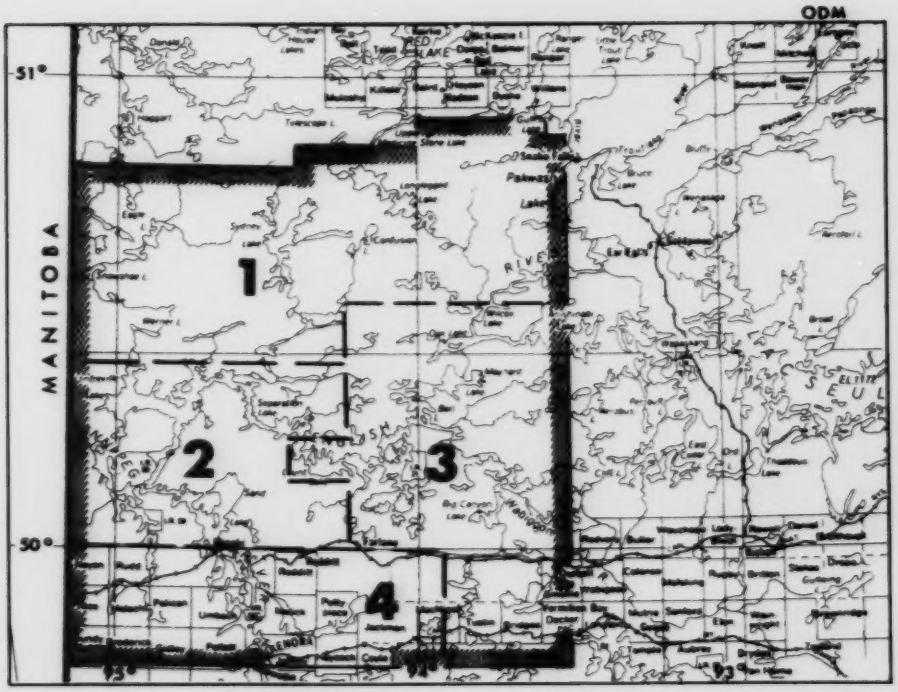
No.3 OPERATION KENORA-SYDNEY LAKE

DISTRICT OF KENORA

by

F.W. Breaks[1], W.D. Bond[1], G.H. McWilliams[2], C. Gower[3]

LOCATION: Operation Kenora-Sydney Lake involved the helicopter-supported reconnaissance mapping of the area bounded by Latitudes 49°45'00" and 50°55'00"N and Longitude 93°30'00"W to the Manitoba border; a total of approximately 5,000



LOCATION MAP

Scale: 1 inch to 25 miles

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square miles (13000 km^2). In more comprehensible limits, the map-area includes most of the area from Kenora to Red Lake and from the Manitoba border to just west of the Red Lake Highway 105.

Numerous roads and an extensive interlocking lake system in the southern portion of the map-area provide easy access. Only two roads extend northward as far as the central portion of the map-area. The Jones road trends north-northeast from Kenora passing near the Grassy Narrows Indian Reserve and finally terminating at Oak Lake a distance of approximately 75 or 80 miles (120-128 km). The other road trends north-northwest from Kenora, passing through Minaki and terminating at Umfreville Lake a distance of approximately 75 miles (120 km). The northern portion of the map-area, i.e. north of the English River system, is less accessible as the few roads traverse only the eastern margin of this area. Also the Lake systems in the north are more isolated in that the interconnecting river system are poorly drained and generally not navigable by watercraft. Consequently, this portion of the map-area is most readily accessible by fixed-wing aircraft based at Red Lake.

Bedrock exposure attains its greatest density in the southwest part of the map-area where locally it is up to 90 percent. Northward and eastward from there, the amount of exposure decreases considerably. The extreme north-eastern and eastern portions of the map-area are poorly exposed.

There are six main areas of metasedimentary-metavolcanic assemblages within the map-area, viz at Bee Lake, Werner Lake, Separation Lake, northwest of Pakwash Lake, Tustin-Bridges Townships area and in the Kenora area. Except for the Pakwash Lake area and the Separation Lake belt all of these have been recently mapped in some detail and only brief attention was given to these areas. Emphasis was placed on those areas that were previously unmapped or had received only a cursory examination.

The map-area was divided into four parts, with the program in each part directed by one of the above authors. The reader is referred to the location map for the limits of these four areas.

GENERAL GEOLOGY: The map-area lies within the Superior Province of the Precambrian Shield and includes portions of three structural-lithological subprovinces. About 70 percent of the map-area is underlain by the English River Subprovince. In the map-area, this subprovince is bordered to the south by the Wabigoon Subprovince, and to the north by the Uchi Subprovince.

(1) PAKWASH LAKE-EAGLE LAKE SUBAREA

MINERAL EXPLORATION: Initial mineral exploration within the Pakwash Lake-Eagle Lake area focused upon the Dixie Lake metavolcanic-metasedimentary belt, although prospecting here has been generally handicapped by poor to negligible

rock exposure in many parts of the area coupled with previous lack of geological mapping. Gold mineralization was discovered along Dixie Creek in 1941 by N. Anderson and C. Haryett. During the same year, J. Mitchell staked 24 claims covering four zones of mineralization, all of which were investigated by trenching and shallow diamond drilling[1]. In 1945, this claim-group was optioned by Belgold Mines Limited and development proceeded with additional trenching and diamond drilling. At an unestablished subsequent date, Messrs. Currie, Mahoney, and McDougall re-examined this gold property with eight diamond drill holes totalling 861 feet (262 m)[1].

In 1946, C. Alcock and C. Gordon concurrently held contiguous claim-groups near the east end of Bug Lake. Gold mineralization was reported by C. Alcock[1]. The International Nickel Company of Canada Limited staked 30 claims in seven groups within the Dixie Lake belt in the 1960s although no information as to the nature of exploration was filed for assessment work credits (A.P. Pryslak[2], personal communication).

During 1969-1972 Caravelle Mines Limited and Newmont Mining Corporation of Canada Limited engaged in a joint exploration venture designed to investigate the base-metals sulphide possibilities within the Dixie Lake belt. A large claim-group of 402 claims was covered by an airborne, combined Input electromagnetic and proton magnetometer survey encompassing about 40 square miles (104 km^2) (File 63.3001, Assessment Files Research Office, Ontario Division of Mines, Toronto). A diamond drilling program initiated in early 1970 and terminated in 1972, intersected only minor base-metals sulphide mineralization. A total of 4,344 feet (1324 m) of drilling was completed in 15 holes (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Elsewhere in this part of the map-area only meager and desultory mineral exploration has been documented prior to a joint exploration venture of Selco Mining Corporation Limited, Cochenour Willans Gold Mines Limited, and Coin Lake Gold Mines Limited which was initiated in 1972. During the early 1940s, W. Gray of Red Lake discovered base-metal sulphide mineralization accompanied by silver and gold 'values'[1] at the north end of Sydney Lake. Mextor Minerals, who optioned this property from Mr. Gray in 1971, carried out ground electromagnetic and magnetic surveys delineating a conductive zone approximately 2,700 feet (823 km) in length. Three diamond drill holes totalling 1,613 feet (492 m) intersected massive to disseminated sulphide mineralization along this zone (File 63.285, Assessment Files Research Office, Ontario Division of Mines, Toronto). Falconbridge Nickel Mines Limited carried out ground electromagnetic and magnetic surveys in 1971 on an adjacent claim-group (File 63.2823, Assessment Files Research Office, Ontario Division of Mines, Toronto).

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[1]Information from Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake.

[2]Resident Geologist, Ontario Ministry of Natural Resources, Red Lake.

In 1971, R.A. Frank staked 10 claims in a group situated about ½ mile (0.8 km) west of Stone Lake, partially covering metavolcanics of the Bug Lake-Rainfall Lake extension of the Dixie Lake belt. The objective of the search is not recorded but some trenching and stripping was undertaken on three claims[1]. This claim group subsequently lapsed. A ground magnetometer survey was carried out over a portion of the R. Wagner claim-group during 1972, to define the limits of a magnetite-bearing iron formation. Three of R. Wagner's claims which are situated within the Dixie Lake belt about 1¼ miles (2.4 km) west of Pakwash Lake, are presently in good standing (File 2.1047, Assessment Files Research Office, Ontario Division of Mines, Toronto).

Recently, beginning in 1972, Selco Mining Corporation Limited, Cochenour Willans Gold Mines Limited and Coin Lake Gold Mines Limited embarked upon a joint exploration program designed to investigate the mineral potential of the Sydney-Longlegged-Rainfall Lakes area. This program initially focussed upon evaluating the former Gray property. Following an airborne combined electromagnetic-magnetic survey in 1973, which covered approximately 250 square miles (650 km^2), moderate activity ensued with staking of 140 claims (11 groups), geological mapping, and diamond drilling totalling 3,693 feet (1126 m) in 14 drill holes. This program is still in progress[1].

GENERAL GEOLOGY: Main emphasis in the northernmost subarea was placed on the largely unmapped region between Pakwash Lake and Sydney Lake. Previous mapping at reconnaissance and detailed scales was done within the subarea by Bruce (1924), Derry (1930), Carlson (1957), and Shklanka (1967). The latter two map-areas received relatively little attention by the present survey. The remaining area situated west of Sydney Lake and lying adjacent to the northern and eastern fringes of Carlson's and Shklanka's map-areas, respectively, received only systematic helicopter coverage.

The subarea is divided approximately into halves by a prominent, easterly trending zone of dislocation, herein termed the Sydney Lake Cataclastic Zone, which was traced continuously across the northern subarea from Octopus Lake on the Manitoba-Ontario interprovincial boundary to Pakwash Lake on the east, a distance of 75 miles (120 km).

This zone is significant in representing a fundamental break between the Uchi Subprovince to the north and the English River Subprovince. Near the southern end of Longlegged Lake a major bifurcation occurs in the cataclastic zone with a northern arcuate branch extending to central Pakwash Lake and a south branch extending to and along the south shore of Pakwash Lake. The width of the cataclastic zone varies between 0.3 and 0.9 miles (0.5 and 1.5 km). Cataclastic foliation is vertical or steeply dipping to the south. Rocks occurring within the zone comprise protomylonitic, metasedimentary migmatites of the English River Subprovince and trondhjemitic to granodioritic

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[1]Information from Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake.

rocks of the Uchi Subprovince. Mylonites are locally developed as intercalated narrow to broad bands within less comminuted protomylonite, and often range between 30 feet (9 m) and 300 feet (92 m) in width. Ultramylonite and phyllonite were also recognized locally.

The intermittant presence of pseudotachylite is notable along this zone as well exemplified by occurrences on Sydney Lake and Confusion Lake. This material resembles chilled diabase, occasionally exhibits concentric flowage lines, and carries fragments of the protomylonite host. It was observed either along late shears, or as discordant intrusive veinlets postdating formation of the protomylonitic fabric.

Juxtaposition of metatexitic metasedimentary migmatites and unmigmatized metagreywacke-pelitic sequence along this fault zone on Pakwash Lake possibly infers an upward, vertical relative movement of the southern side of the cataclastic zone. Amount of lateral movement is presently unknown.

Uchi Subprovince: One of the striking features of the Uchi Subprovince within the map-area is the presence of several elliptical geological structures, rendered conspicuous by ovoid magnetic anomalies (Aeromagnetic Maps 4010G and 4011G) and to a lesser extent by topographic features. These structures are situated in the Sydney Lake, Longlegged Lake, Medicine Stone Lake area and are named by the author as follows:

(1) Sydney Lake-Rainfall Lake Dome, and

(2) Longlegged Lake Dome

A third similar structure is probably centred between Medicine Stone and Upper Medicine Stone Lake, but this area was largely unexamined by the present survey.

The Longlegged Lake overturned dome measures 14 miles (22 km) in length and 5 miles (8 km) in width. This dome is comprised of intercalated amphibolite, biotitic quartzo-feldspathic gneiss, hornblende-biotite quartzo-feldspathic gneiss, and medium-grained biotite trondhjemite gneiss units mantling a core zone consisting of foliated, metamorphosed, homogeneous to gneissic and xenolithic trondhjemite. Massive to foliated, fine-grained to medium-grained, amphibolite units, frequently containing epidote, are especially prominent in the mantle zone. One particular amphibolite band can be traced continuously for about 40 miles (64 km) around the southern and northeastern periphery of the dome before widening and coalescing with amphibolitized pillowed mafic metavolcanics of the Dixie Lake metavolcanic-metasedimentary belt. The fine-grained biotitic quartzo-feldspathic gneisses probably represent greywacke that has undergone metatexitic migmatization. Several small, massive, metamorphosed, medium- to coarse-grained, gabbro to hornblendite intrusive bodies occur both within and proximal to the Sydney Lake-Rainfall Lake and Longlegged Lake domes.

The Sydney Lake-Rainfall Lake dome, measuring 19 miles (31 km) in length and 5 miles (8 km) in breadth exhibits quaquaversal dips ranging quite frequently between 35 and 50 degrees. This dome plunges antiformally to the southwest under the north end of Sydney Lake and terminates to the northeast near Bug Lake, again probably as an antiform.

Both the core and mantle zones of the Longlegged Lake and Sydney Lake-Rainfall Lake structures were the loci of numerous late-tectonic stocks and dikes of unmetamorphosed, medium- to coarse-grained, leucocratic biotite quartz monzonite which have obliterated the original core-mantle relations in many areas.

The Dixie Lake metavolcanic-metasedimentary belt possesses a ramiform configuration with several prominent branches extending respectively to the south, southwest, and west from a central mass. Two previously unmapped isolated remnants of foliated to pillowed amphibolitized mafic metavolcanics extending southwest to the south end of Longlegged Lake probably represent a relict arm of this belt. These remnants are now separated by metamorphosed quartz diorite and biotite trondhjemitic batholithic masses.

Rock exposure in the northern half of this belt and within the Bug Lake-Stone Lake extension is fair to moderate, but in the central, southeastern, and southern parts is poor to non-existent.

The Dixie Lake belt is dominantly composed of a thick sequence of pillowed to massive, mafic to intermediate metavolcanic flows. Individual flows are typically thin, varying between 6 and 30 feet (2 and 9 m) in thickness. Volcanic rocks of intermediate composition constitute the second most abundant rock type and occur as finely laminated tuff units, massive flows, and as local tuff-breccia units. A prominent, previously unmapped, predominantly tuffaceous unit occurs in the northern part of the Dixie Lake belt. This unit gradually widens eastward for at least 14 miles (22.4 km), from just east of Bug Lake. This unit is at least 2 miles (3.2 km) wide near Rice Lake (local name). A quartz monzonite batholith near Stone Lake appears to have removed a small segment of this unit by stoping. Minor intercalated bands of greywacke, argillite, and quartzite are also present. Oxide facies iron formation has been identified in diamond drill intersections and inferred from aeromagnetic data (File 63.3001 Diamond Drill Reports, Assessment Files Research Office, Ontario Division of Mines, Toronto). A small ramiform septum of metavolcanic rocks was traced along the western shoreline of Pakwash Lake and represents a previously unknown southward extension of the Dixie Lake belt. This septum contains amphibolitized, foliated equigranular and pyroclastic mafic metavolcanics, dacitic tuff, lapilli tuff, and heterolithologic tuff-breccia. Also notable is the presence of volcanogenic conglomerate containing exotic clasts of medium-grained massive leucocratic trondhjemite. Feldspar porphyry dikes are locally apparent, particularly within the dacitic metavolcanics.

English River Subprovince: High grade metasediments and derived migmatite occur extensively along the northern perimeter of the English River Subprovince. These are abruptly truncated in the north by the Sydney Lake Cataclastic Zone, and in the south partly extend into the Oak Lake-Daniels Lake and Umfreville Lake subareas. A wide variety of granitic plutonic complexes locally interrupt the continuity of this supracrustal assemblage.

The metasedimentary component consists of a light-brown to light-grey weathering, fine-grained, foliated to gneissic rock of probable greywacke bulk composition. These rocks have undergone migmatization to varying degrees. The metasedimentary migmatites are believed to have developed by anatexis and for mapping purposes have been classified as metatexites and diatexites (Mehnert 1968). The metatexitic migmatite is composed of 20 to 50 percent white weathering, medium-grained to pegmatitic, leucocratic hypidiomorphic-granular, biotite, almandine-biotite, and cordierite-almandine-biotite unmetamorphosed mobilizate ranging in composition between quartz monzonite and trondhjemite. More advanced stages of anatexis are characterized by medium- to coarse-grained inhomogeneous and homogeneous granitoid diatexite, exemplified in the region near Conifer Lake. The inhomogeneous diatexite contains appreciable contorted blocks and schlieren of metasedimentary and metatexitic migmatite; twisted blocks of resistant amphibolite are sometimes conspicuous. Homogeneous diatexite is characterized by a very minor level of contamination and may occur as broad bands within and transitional into metatexite or as small allochthonous plutons.

Occasionally, biotitic homogeneous diatexite of quartz dioritic to dioritic composition was encountered. All types of diatexite universally display idiomorphic plagioclase and white potassic feldspar, and fractured nonpolygonized quartz.

Pelitic rocks are of uncommon occurrence within the migmatized metagreywacke and are usually thin-bedded. Conceivably, this reactive rock type has been pervasively obliterated by high grade regional metamorphism.

Magenta to red-brown coloured almandine garnets are ubiquitous within paleosome and mobilizate of the area studied. Cordierite-almandine-biotite mobilizate is particularly common in the Pakwash Lake-Wegg Lake area. Cordierite in this area is evident as large, vitreous, homogeneous, mauve to purplish-blue, anhedral to subhedral crystals varying between 5 mm and 2 cm diameter. Cordierite also occurs within medium-grained clotty aggregates accompanied by biotite, almandine, quartz and occasionally muscovite.

ECONOMIC GEOLOGY: Gold associated with sulphide mineralization occurs on the former property of Belgold Mines Limited in the central part of the Dixie Lake belt. Gold values were confirmed by R. Thompson in two of four closely spaced mineralized zones exposed through trenching[1]. The principal showing (Zone A),

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[1]Information from Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake.

occurs within a narrow northerly trending iron-formation unit enclosed by mafic metavolcanics. Gold is confined to zones of silicification accompanied by disseminations and irregular masses of pyrite, pyrrhotite, and chalcopyrite. Five mineralized specimens selected for assay by R. Thompson from Zone A returned gold values varying between nil and 0.33 ounce of gold per ton[1]. A second showing referred to as Zone D located about ½ mile (0.8 km) northwest of Zone A consists of quartz veins emplaced within mafic metavolcanics mineralized with disseminated to stringy pyrrhotite, pyrite and chalcopyrite. Three specimens selected for assay by R. Thompson reported nil to 0.19 ounce gold per ton[1].

The diamond drilling program of Caravelle Mines Limited and Newmont Mining Corporation of Canda Limited has intersected several mineralized zones consisting principally of massive to disseminated pyrrhotite and pyrite (very minor chalcopyrite) contained within graphitic argillaceous metasediments, felsic to intermediate tuffaceous rocks, and mafic metavolcanics. Assay results, revealed only very low content of precious metals (gold and silver) and base metals (Diamond drill Reports 10 to 16, Assessment Files Research Office, Ontario Division Mines, Toronto).

Near Bug Lake in the north-central part of the map-area, C. Alcock in 1946 reported gold values ranging up to 0.23 ounce of gold per ton occurring within pyritized sericite schist shear zones. A property examination by R. Thompson[1] failed to reveal any significant gold mineralization, although the exact location of the high gold values reported by Alcock could not be ascertained.

Base metal sulphide mineralization accompanied by gold and silver occurs in sheared migmatized metasediments on the former Gray property located at the north end of Sydney Lake. Trenching has exposed an 18 foot wide mineralized zone composed of sheared fine- to medium-grained biotite-muscovite quartzofeldspathic rocks carrying massive to disseminated pyrite, pyrrhotite, sphalerite, chalcopyrite, arsenopyrite, and molybdenite, listed in order of approximate decreasing abundance. Disseminated pyrite and chalcopyrite extends into massive to well-foliated, medium- to coarse-grained pink granitic wallrocks for distances up to 5 feet (1.5 m) from the shear zone. Partially digested biotite amphibole metasediments locally abound in the granitic intrusive phases. Layered fine- to medium-grained biotite quartz monzonite with pegmatitic veins and masses occurs west of the trench. Diamond drilling by Mextor Minerals encountered disseminated to massive sulphide mineralization, particularly associated with pink pegmatite. Best assays recorded by Mextor Minerals (file 63.2835, Assessment Files Research Office, Ontario Division of Mines, Toronto) are indicated below:

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[1]Information from Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake.

Metal	Assay Value	Assay Width	
Zinc	9.27%	5.0 feet	Drill Hole No. 3
Copper	0.71%	5.0 feet	Drill Hole No. 3
Silver	2.08 oz/ton	32 inches	Trench
Gold	0.28 oz/ton	25 inches	Trench

Two grab samples of disseminated to patchy segregations of pyrite, pyrrhotite, and chalcopyrite exposed in the trench were submitted, by the author, to the Mineral Research Branch, Ontario Division of Mines for assay and registered the following values:

Sample No.	Copper	Zinc	Nickel	Gold	Silver
EE 11-1	0.23%	0.38%	45 ppm	tr	0.50 oz/ton
EE 11-2	0.36%	0.03%	26 ppm	0.01 oz/ton	0.19 oz/ton

The best copper and zinc intersections reported by Cochenour Willans Gold Mines Limited, Selco Mining Corporation Limited, and Coin Lake Gold Mines Limited in 1972 are documented below (Diamond Drill Reports, Assessment Files Research Office, Ontario Division of Mines, Toronto):

Diamond Drill Hole	Claim No.	Width	Copper	Zinc	Gold	Silver
S-73-1	KRL322559	8.6'	1.96%	2.84%	0.005 oz/ton	0.59 oz/ton
S-73-14	KRL322561	14.0'	0.22%	4.60%	--	Trace

Recommendations for Future Mineral Exploration: Despite easy accessibility, the Dixie Lake metavolcanic-metasedimentary belt appears to have been largely bypassed by saturation-type mineral exploration programs to date. This situation is largely related to a paucity of previous geological mapping west of Longitude 93°30'W. It is recommended that a more intense study of the mineral possibilities of the Dixie Lake belt now be considered. To the writer's knowledge no systematic mineral exploration has been done either in the Bug Lake-Stone Lake extension or in the adjoining northern confines of the Dixie Lake belt. Both areas contain major tuffaceous units and local lapilli-tuff and tuff-breccia units of intermediate composition. Additionally, some examination of the former Caravelle Mines Limited-Newmont Mining Corporation of Canada Limited exploration area may be considered in light of the numerous interesting, unprobed, electromagnetic conductors present (cf. File 63.3001, Assessment Files Research Office, Ontario Division of Mines, Toronto).

(2) UMFREVILLE-SEPARATION LAKES SUBAREA

MINERAL EXPLORATION: Records of mineral exploration in the Umfreville-Separation Lakes area dates back to 1937 with the work on the Minaki pyrite mine on Vermilion Lake. D.F. Hewitt (1967, p.36) reports reserves of 1,432,400 tons of ore to a 250-foot depth averaging 41 percent sulphur. Development work on the deposit included 22 test pits and 20 drill holes. In 1963, C. Alcock found a similar showing in mafic metavolcanics on Perch Lake along strike from the Minaki pyrite mine.

There has been little recorded exploration for base metals in this subarea. Stratmatt Limited, in 1956, drilled a small gabbro and diorite stock just north of the village of Redditt. Seventeen holes with a total depth of 1,773 feet (540 m) encountered several zones of disseminated chalcopyrite and pyrrhotite with minor magnetite[1]. In 1963, Canadian Nickel Company Limited recorded stringers and disseminated pyrite and pyrrhotite in a 474-foot (144 m) hole south of Patterson Lake[1].

Although iron formation is poorly exposed in the area linear magnetic highs (ODM-GSC Aeromagnetic Map 1181G) in the Separation Lake area clearly indicate an extensive zone. Trenching and feasibility studies of the property were conducted by W.S. Moore Company of Duluth in the period 1948-1955 and by Tombill Gold Mines Limited and Glen Echo Mines Limited in 1957. Results of these studies indicate that the iron mineralization has excellent concentration characteristics but does not occur in sufficient widths to apply open pit mining methods.

From the late 1960s up until the present, several airborne scintillometer surveys have been conducted in the area. In 1967, Headvue Mines Limited worked on a block between Octopus and Vermilion Lakes and in 1968, Colman Morton surveyed an adjoining area between Vermilion and Sand Lakes[1]. Bralorne Resources Limited and Can-Fer Mines Limited conducted scintillometer and geological surveys in the Oneman Lake (now part of Umfreville Lake) and Tourist Lake (now part of Umfreville Lake) areas during 1968 and 1970. These surveys encountered anomalous but sporadic U_3O_8 values associated with the pegmatites in the area[1].

Exploration during the 1974 field season included a geological reconnaissance survey by Selco Mining Corporation Limited in the Umfreville-Separation Lake metavolcanic-metasedimentary belt (G. Pollack[2], personal communication). Sherritt Gordon Mines Limited was conducting an electromagnetic survey and extensive drilling on several grids near Oneman Lake and along the English River east of Oneman Lake.

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[1]Information from Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake.

[2]Geologist, Selco Mining Corporation Limited.

GENERAL GEOLOGY: Massive to foliated, locally pillowed, intermediate to mafic metavolcanics of the Separation Lake area form a southern margin to the metasedimentary belt of the Umfreville-Separation Lake area. The greatest preserved thickness (in excess of 1½ miles, 2.2 km) of these metavolcanics occurs at Separation Lake with a tapering off both to the east and west. North of Routine Lake (now part of Umfreville Lake) the metavolcanic sequence is less than 100 feet (30 m) wide. These metavolcanics commonly are dark green to black, banded amphibolites. Where found, pillows were poorly preserved and usually stretched to the point of being barely recognizable. Only at one location was a facing direction indicated by pillow shape.

Narrow, finely bedded, felsic to intermediate tuff and lapilli-tuff lenses outcrop along the shore of the English River east of Separation Lake. At first glance they resembled banded chert, but on closer examination lapilli sized fragments were discernable. At one location the weathering of fine grained pyrite gives the outcrop a rusty appearance. These lenses were narrow (30 to 40 feet) (9 to 12 m) and not traceable for more than several hundred yards along the shore. One larger (200-foot) (61 m) horizon of tuff and lapilli-tuff can be traced from a small island in the Oneman Lake Indian Reserve east to the flooded, tree covered bay west of the reserve.

A narrow belt of mafic metavolcanics outlined on ODM Compilation Map 2175 (Ferguson et al. 1970) extends from Sand Lake east to Perch Lake. This belt contains a large pyrite zone within schistose amphibolite (see Minaki pyrite mine under "Mineral Exploration").

A massive to weakly foliated belt of amphibolite extend north of Ena Lake to Vermilion Lake. This narrow belt is composed predominantly of dark green intermediate to mafic metavolcanics. One small felsic tuffaceous lens was found within the mafic metavolcanics.

In addition to the metavolcanic and metasedimentary sequences which had been outlined on ODM Compilation Map 2175, several large rafts up to 2 miles (3.2 km) in length were found within the granitic intrusives. These rafts, found east of Snook Lake, on the north shore of the Winnipeg River near the Whitedog Generating Station, at the narrows on the north shore of Tetu Lake, and along the small river which forms the boundary of the Whitedog Indian Reserve, indicate a much larger extent of the metavolcanic and metasedimentary belts than is presently preserved.

The intrusive rocks were subdivided on the basis of composition and on the presence or absence of metamorphic textures. In most of the area, these classes were well defined and helped to separate distinctive bodies of similar composition. The metamorphosed intrusive rocks of granodioritic to trondhjemitic composition commonly have an east-trending foliation parallel to the foliation of the metavolcanics and metasediments. A large batholith of unmetamorphosed granite and quartz monzonite straddles the Ontario-Manitoba border in the Tetu Lake area. Contact relationships and the unmetamorphosed

character indicate that this batholith represents the latest intrusive event in the region with the exception of a small northwest-trending diabase dike which crosses the eastern margin of the batholith. Sills and dikes of similar quartz monzonite commonly intrude the metamorphosed intrusive rocks of the western part of the map-area.

East-trending metasedimentary migmatites are well exposed along the shores of Routine, Oneman and Salvesen Lakes. These metasediments are commonly biotite-plagioclase ± cordierite ± garnet ± amphibolite schists with discontinuous interlayers of anatectic potassic feldspar, quartz ± plagioclase. Biotite contents in excess of 15 percent suggest that most of these gneisses were originally greywacke. Fine, biotite-rich laminae within these greywackes represent former pelitic beds. In most instances no trace of original bedding has been preserved.

In general the contact of the metasedimentary belt corresponds to that outlined on ODM Compilation Map 2175. The one exception is the linear band south of Umfreville Lake. This area outlined as metasediments is dominantly granitic with raft-like inclusions of former sediments.

RECOMMENDATIONS TO PROSPECTORS: Much of this subarea has been overlooked by prospectors in the past. Previous mapping was limited to the major waterways with aeromagnetic extrapolation of the vast area in between. The presently known mineral occurrences are all located along or near rivers indicating that previous workers have not completely penetrated the area.

The absence of overburden in 80 percent of the area makes it an excellent region for the application of airborne scintillometer survey methods. Previous surveys in the area encountered high background uranium values (see "Mineral Exploration"); anomalies are concentrated near pegmatites which are abundant throughout the area.

(3) OAK LAKE-DANIELS LAKE SUBAREA

MINERAL EXPLORATION: Almost all of the known prospecting activity in the Oak Lake-Daniels Lake subarea has been centred in the Tustin-Bridges Townships area to date. A great deal of the exploration thus far has been for uranium associated with small pegmatite bodies. Pryslak (1972) conducted a detailed mapping program in this area and the reader is referred to his report for a more extensive account of the past exploration activities.

According to the assessment files of the Regional Geologist in Kenora, only three other areas within the map-area have been investigated. In the

late 1930s, five trenches were excavated and at least seven holes diamond drilled on a sulphide showing just south of Helder Lake[1]. No records for the drilling are known to exist.

In 1956, nine claims located near the southeastern part of Oak Lake were held by K. Koezur, F. Koezur and M. Mahoney. Several trenches were dug and six X-ray diamond drill holes (443.2 feet) (135.1 m) were drilled to investigate a sulphide showing (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake). Minor uranium-bearing pegmatite dikes were also found nearby. No further work has been recorded on the property.

Mr. M. Mahoney also drilled three diamond drill holes (212.2 feet) (64.7 m) near the west part of Oak Lake. Although the date is not shown on the assessment file in Kenora, this was also probably done around 1956. Some weak geiger counter responses were reported on the drill core[1]. No further work was submitted as assessment credits.

More recently Mr. J.R. MacLeod has done extensive trenching on a claim group situated approximately 1 mile (1.6 km) northeast of Alexandra Lake on the eastern boundary of the map-area. No explanation for the trenching was given in the assessment file (Assessment Files Research Office, Ontario Division of Mines, Toronto).

During the present field season, Sherritt Gordon Mines Limited was active at Helder Lake and at several of the localities of mafic metavolcanic rafts south of Oak Lake and at the east end of the lake.

GENERAL GEOLOGY: As evident on the regional compilation maps covering the map-area (Davies and Pryslak 1967; Ferguson et al. 1970), the geology of this portion of the map-area was largely unknown until the present. Reconnaissance mapping by Bruce (1924) and Derry (1930) included only the extreme northwestern and western portions of the Oak Lake-Daniels Lake subarea respectively. The nature of the regional geology was partly revealed by Divibedi (1968) who, in sampling along the Jones road disclosed much of the area to be underlain by granitic intrusive rocks. In addition, portions of two metavolcanic-metasedimentary belts lie within the area.

Tustin-Bridges Metavolcanic-Metasedimentary Belt: The Tustin-Bridges Townships area was mapped in detail by Pryslak (1972) and consequently, only brief attention was directed towards this portion of the map-area in order to tie the detailed mapping in with the present mapping program. According to Pryslak (1972), the belt trends east, varying in width from 100 feet (30 m) to 4 miles (6.4 km). The metavolcanics are mafic to intermediate in composition and composed of flows and pyroclastics. Metasediments, predominantly greywackes,

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[1]Information from Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora.

are intimately associated with the metavolcanics. Pryslak (1972) also states that "the sequence was intruded by sills, dikes and irregular bodies varying in composition from felsic to intermediate". The margins of the belt and the thinner portions have been migmatized by the injection of mostly concordant granitic dikes and this is especially evident in some of the road exposures in MacNicol and Tustin Townships. At Daniels Lake a leucocratic, fine-grained metamorphosed trondhjemite stock has intruded a foliated to locally gneissic trondhjemite sequence that is in contact with the Tustin-Bridges metavolcanic-metasedimentary belt. Approximately one-third of this stock is bordered by a thin (100 to 400 feet, 30.5 to 122 m) lens of mafic, amphibolitized metavolcanics that are migmatitically injected by granitic sills and no doubt these metavolcanics were at one time part of the Tustin-Bridges metavolcanic-metasedimentary belt.

Separation Lake Metavolcanic-Metasedimentary Belt: This belt, located near the northwestern part of the subarea, was reasonably well defined by Derry (1930). The rocks are characteristically composed of fine- to medium-grained mafic metavolcanic flows that are frequently impregnated by leucocratic granitic intrusive dikes. A thin 200 to 300 feet (61 to 91 m) lens of lapilli-tuff of unknown extent was observed near the southern boundary of the belt at Helder Lake. The pyroclastic unit is characterized by felsic (dacitic to rhyodacitic) fragments in a mafic, amphibolitized matrix. Some of the matrix itself may actually be composed of mafic fragments that have lost their identity during subsequent deformation. The termination of the Separation Lake belt is consistent with that proposed by Derry (1930) although isolated pockets of amphibolitized mafic metavolcanics that are probably remnant rafts of the eastern extension of this belt are present at several localities south of and east of Oak Lake. The two most extensive areas of mafic metavolcanics are located approximately 3 miles (4.8 km) south of the junction of the Jones road and Oak Lake and 3 miles (4.8 km) east of Oak Lake. Both of these bands carry disseminated pyrite and pyrrhotite in places.

English River-Type Metasedimentary Migmatites: English River-type metasedimentary migmatitic rocks occupy a band between Campfire Lake and Helder Lake that thins rapidly towards Oak Lake. The band continues north of Oak Lake and extends almost to the eastern part of Oak Lake before it curves northwards out of the subarea. Locally the trend and the contact of the metasedimentary migmatites is marked by lineaments but for the most part, is obscured by extensive overburden. The metasedimentary migmatites constitute 10 to 12 percent of the subarea; their distinctive orange-brown colour resulting from the weathering of biotite makes them easily conspicuous in the field.

The migmatitic rocks are dominated by fine-grained metasediments that are compositionally greywackes and are composed essentially of biotite-quartz-plagioclase and nearly always garnet. Deformation has destroyed almost all

primary structures although bedding was observed on several outcrops. A very few felsic beds which may be either arkosic or tuffaceous in character are present at a few localities. Dark-green, biotite-chlorite? rich pelitic? beds are present locally. Conglomerate, composed mainly of metavolcanic fragments ranging in composition from mafic to felsic, is present near the margin of the metasedimentary belt at Oak Lake but is only exposed on one small island.

A granitic mobilizate resulting from the segregation of leucocratic minerals through anatexis (anatexis may not be the sole process involved) is present in varying proportions with these metasediments. Based on the proportion of mobilizate present these metasedimentary migmatites were classified into the metatexite and diatexite as described previously in "Pakwash Lake-Eagle Lake Subarea". Textures and structures attributed to varying stages of segregation are often present on single exposures and make the outcrop appear more complex and heterolithologic than it actually is. The leucocratic mobilizate is often coarse-grained, leucocratic quartz monzonite in composition. Garnets are almost invariably present. Towards the southern margin of these metasedimentary migmatites, the heterogenetic character of these rocks is intensified by the presence of more than one granitic component. It remains to be determined what the true origin of these differing granitic components are; they may be: i) intrusive in origin; ii) the result of in situ anatexis of the metasediments or; iii) allochthonous anatexites. Massive, leucocratic, pink quartz monzonite containing garnets is present in several areas just south of Oak Lake and these may also have been derived from anatexis of the metasediments.

Granitic Intrusives: Approximately 80 to 85 percent of the map-area is underlain by granitic intrusive rocks. In the field these rocks were classified into two categories: i) metamorphosed and, ii) unmetamorphosed varieties. The limits of the more distinctive granitic bodies were reasonably well-defined but many are composed of several phases that were not easily differentiated in reconnaissance scale mapping. Critical outcrops defining relative ages of neighbouring batholiths and plutons were uncommon.

The older, metamorphosed varieties are often trondhjemitic to granodioritic in composition and often display a foliation. North of the Tustin-Bridges metavolcanic-metasedimentary belt, well-foliated trondhjemite that locally displays a gneissic banding is exposed. Possibly the discontinuous banding represents relict inclusions that have been partly resorbed. At Daniels Lake, a fine-grained, weakly foliated, leucocratic trondhjemite stock is intrusive into the foliated to gneissic trondhjemite. Part of the margin of this leucocratic stock is rimmed by migmatized, amphibolitized mafic metavolcanics. The area south from Oak Lake to Grassy Narrows Lake is also underlain by metamorphosed intrusives including trondhjemite, granodiorite and porphyritic granodiorite. Although the majority of the more potassic granitic intrusions tend not to be metamorphosed it is interesting to note that a northeast-trending, foliated, leucocratic, fine-grained quartz monzonite which underlies the eastern portion of Oak Lake has been metamorphosed.

A large batholith of massive, homogeneous, unmetamorphosed porphyritic granodiorite, extends from just south of Canyon Lake up to Grassy Narrows Lake. The rock is characterized by zoned, randomly oriented, potassic feldspar crystals averaging 1 to 1.5 inches (2.5 to 3.8 cm) in length supported in a trondhjemitic matrix. In places, the concentration of these phenocrysts varies considerably. The northern margin of the batholith is markedly sparse in the phenocrysts while several, concordant central portions are fairly densely populated. The phenocrysts in the latter portions are aligned and this is probably a primary flow alignment. Leucocratic, massive, orange-red quartz monzonite forms sills, dikes and small stocks that appear to be the youngest intrusive phases. These intrusions seem to have taken advantage, wherever possible, of pre-existing planes of weakness such as contact zones, with the result that some of the contacts are nebulous in that they are migmatitic.

Structural Geology: Several large fold structures have been delineated in the map-area and are found: i) between Daniels Lake and Gordon Lake; ii) near Campfire Lake; and iii) just south of Maynard Lake. These structures are largely a result of the adjustment and deflection of the host rocks around nearby granitic intrusions.

No evidence of a major cataclastic zone as postulated by Wilson (1971) to exist immediately north of the Kenora metavolcanic-metasedimentary belt was found, although the metamorphosed porphyritic granodiorite extending from Ball Lake to Toole Lake is weakly sheared and locally displays a proto-mylonitic texture (Spry 1969, p.229).

ECONOMIC GEOLOGY: Uranium and massive sulphides are the two main commodities being sought in the map-area. According to Pryslak (1972), sulphides (pyrite, pyrrhotite, and rare chalcopyrite) associated with the metavolcanic sequence, and uranium associated with pegmatite intrusives are the only minerals of importance discovered to date in the Tustin-Bridges Townships area. The sulphides are insufficiently concentrated and the uranium-bearing pegmatites are too small and discontinuous to be economically important. There has been no mineral production within the subarea to date.

On the west shore of a small bay located on the south side of the east end of Oak Lake, 5 to 10 percent disseminated pyrite and pyrrhotite are associated with a concordant, metamorphosed quartz vein. The zone, which strikes N35E and dips 60 degrees to the northwest, is 12 feet (3.6 m) wide and, although it is discontinuous along some of this length is approximately 1,000 feet (305 m) in length. The sulphides occur as small isolated pods and veinlets in the quartz vein and are also disseminated within the host mafic metavolcanics. Green (malachite?) staining was found locally and may indicate the presence of copper sulphides. This is the same zone that was examined by K. Koezur in 1956, (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake) several old test pits and strippings were still visible.

Disseminated (1-2 percent) pyrite was also found associated with the thin, folded mafic metavolcanic lens that is situated about 3 miles (4.8 km) east of Oak Lake. The disseminated sulphides occur in isolated, loosely aggregated pods. Amphibole is locally concentrated in these pods.

Disseminated (5 percent) to locally massive pyrite is also associated with quartz veins in mafic metavolcanic rafts at several localities at the west end of Oak Lake but the discontinuous nature of these isolated metavolcanic bodies restricts their economic potential.

Uranium is reported in drill logs on the two old properties near Oak Lake (the Koezur and Mahoney claim groups, see "Mineral Exploration") but is of low grade. The uranium appears to be associated with small discontinuous pegmatite bodies. No brownish-yellow staining indicative of uranium was noticeable on the surface exposure of these pegmatite dikes or on other dikes observed in the subarea.

(4) SILVER LAKE-PELICANPOUCH LAKE SUBAREA

MINERAL EXPLORATION: There is little evidence of previous mineral exploration in this part of the English River Subprovince. In the Kenora Subprovince within the subarea Davies (1965) has described pyrite-pyrrhotite mineralization in greywacke south of Gundy Creek, Gundy Township. On the northwest side of Island Lake, east of Kenora, seven holes, totalling 608 feet (185 m) were diamond drilled at the contact between basalt and quartz diorite. Trace pyrite, chalcopyrite and pyrrhotite mineralization in quartz veins was encountered. Three holes totalling 453 feet (138 m) were diamond drilled in diabase ½ mile (0.8 km) southeast of Breakneck Lake, east of Kenora. The nature of mineralization encountered was not described (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

GENERAL GEOLOGY: The subarea straddles the boundary of the English River and Wabigoon Subprovinces of the Superior Province.

English River Subprovince: The rock types in this portion of the English River Subprovince can be grouped into (a) gneisses and migmatites and (b) intermediate to felsic plutonic intrusions.

The gneissic and migmatitic rocks occupy a broad zone 4 to 12 miles (6.4 to 19.2 km) wide and have been extensively intruded by plutonic rocks. The gneisses range in composition from diorite to granite. Gneisses of dioritic composition are commonly associated with amphibolite rafts and exhibit irregular and discontinuous banding. In contrast gneisses of granitic composition usually show continuous, regular banding.

Plutonic rocks of trondhjemite or granodiorite composition are intimately associated with the gneisses. Banding in gneiss adjacent to these plutons is concordant to the intrusive contacts. Characteristically the trondhjemite/granodiorite bodies are medium-grained, leucocratic, nonporphyritic, show some form of internal folding, and lack xenoliths. In places, they contain deformed, parallel-sided mafic bands which may be early dikes.

Less intimately associated with the gneisses are large plutons ranging in composition from diorite to granodiorite. Amphibole is always the dominant mafic mineral and mafic xenoliths are common. The granodiorite phases contain potassium feldspar phenocrysts. Age relationships with associated rocks are uncertain but lack of internal deformation suggests that these rocks were formed late in the intrusive history.

A large body of porphyritic granodiorite to quartz monzonite is present in the northeast part of the subarea. It is massive to weakly foliated, contains either amphibole or biotite as the mafic phase, has rare mafic xenoliths and often has unusually large quartz grains (8 by 5 mm). Potassium feldspar phenocrysts may be up to 6 by 2 cm but average 1.5 by 1.5 cm. The southern contact of the body is strongly deformed and may indicate a major fault. fault.

Quartz monzonite occurs as post-tectonic dikes, sills and irregular bodies throughout the subarea, but is most common in the north where earlier quartz diorite and porphyritic granodiorite have been complexly injected.

Definite pillowed lavas were observed at Ena Lake within the small, curvalinear mafic metavolcanic band situated between Ena Lake and Vermilion Lake (Ferguson et al. 1970, Map 2175) but were too deformed to be useful as top indicators.

Wabigoon Subprovince: The rock types in the Wabigoon Subprovince can be grouped into (a) metavolcanic-metasedimentary sequences and, (b) intermediate to felsic plutonic intrusions.

The metavolcanic-metasedimentary sequences have been mapped by King (in preparation) in the Kenora area and by Davies (1965) in Gundy Township. The northeast arm of the Kenora metavolcanic-metasedimentary belt extends north of Silver Lake and tapers to a band 0.6 miles (1 km) wide. These rocks have been extensively lit-par-lit injected by quartz monzonite. An elliptical structure visible on aerial photographs north of Silver Lake proved to be a basinal structure composed of basalt injected by felsic plutonic rocks. Discontinuous lenses of basalt thoroughly injected by quartz monzonite and granodiorite occur immediately east of Silver Lake. They appear to link up with east-southeast trending basalt units extending from Corner Lake to Willard Lake.

The basalts have been intruded by plutons of both amphibole- and biotite-bearing porphyritic quartz monzonite and granodiorite at Black Sturgeon Lakes (East) and by nonporphyritic quartz monzonite to granodiorite at Silver Lake. A large batholith occurs in the southeast part of the subarea. The margin of the batholith is a xenolithic amphibole-bearing quartz diorite. This grades into a central biotite granodiorite.

Boundary Between English River and Wabigoon Subprovinces: The boundary between the English River and Wabigoon Subprovinces is, at least in part, faulted. West of Kenora a 0.6 mile (1 km) wide band of porphyritic granodiorite has been intruded between gneiss and basalt. A strongly sheared to mylonitic fabric is present in the porphyritic granodiorite marginal to the basalt.

Post-Granite Diabase Dikes: Both the Kenora and English River Subprovinces have been intruded by northwest-trending diabase dikes. Two major dikes were mapped, both extensions of dikes previously located in metavolcanics further south.

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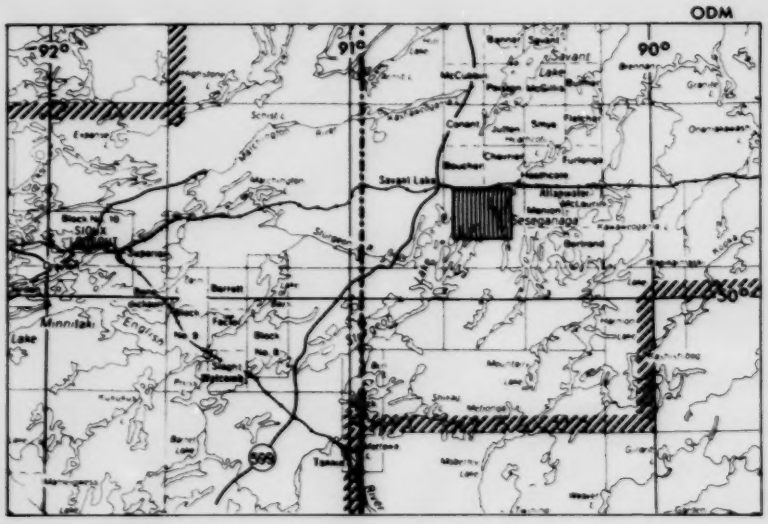
No.4 STURGEON LAKE-CHEVRIER TOWNSHIP AREA

DISTRICT OF THUNDER BAY

by

N.F. Trowell[1]

LOCATION: In 1974, the author began a two-year mapping project in the Sturgeon Lake-Chevrier Township area. The area now covered is approximately bounded by Latitudes 50°07'30" to 50°12'N and Longitudes 90°28' to 90°40'W;



LOCATION MAP Scale: 1 inch to 25 miles

approximately 65 square miles (168 km^2). Much of the western part of the area is accessible from Sturgeon Lake whereas float-equipped aircraft provide access to the eastern part of the area. A lumber road, which at the end of the field season extended from Highway 599 east to Beckington Lake, is presently under construction by Great Lakes Pulp and Paper Company Limited. The Canadian National railway delimits the northern boundary of the present survey.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

MINERAL EXPLORATION: According to W. McInnes (1900) of the Geological Survey of Canada, who first mapped in the Sturgeon Lake area, gold was first discovered in the area in 1898 with the result that extensive prospecting for gold was conducted during the early part of this century. Several old workings (shafts, trenches), presumably for gold, were found during the present survey.

The discovery in 1968, of a Cu-Zn-Ag-Pb (-Au) sulphide deposit by Mattagami Lake Mines Limited, Exploration Division, located approximately 25 miles (40 km) to the southwest resulted in a substantial portion of the present map-area being claimed and prospected. No exploration activity in the map-area was observed by the field party during the past field season.

GENERAL GEOLOGY: The map-area covers the northern extension of the Sturgeon Lake metavolcanic-metasedimentary belt. Within the confines of the map-area the belt is 8 miles (13 km) long and varies in width from 8 to 6 miles (13 to 10 km). It is bounded on both the west and east by granitic batholiths.

The southern portion of the metavolcanic-metasedimentary belt comprises from west to east: (1) a lower mafic to intermediate metavolcanic sequence; (2) a mixed sequence of intermediate to felsic pyroclastic, volcanic clastic and derived volcanogenic metasediments with thin intercalated mafic to intermediate metavolcanic flows; (3) a sequence of mafic to intermediate metavolcanics with thin intercalated pyroclastic and volcanic clastic units; (4) an epiclastic greywacke metasedimentary sequence in the area of Vanessa Lake; and (5) an eastern mafic to intermediate metavolcanic amphibolite sequence.

The central and northern portion of the area comprise a three-part assemblage: eastern (5) and western (1) mafic to intermediate metavolcanic amphibolite sequences with a central sequence of metasediments, fragmental probably pyroclastic rocks, volcanic clastic to volcanogenic metasedimentary rocks, and intermediate porphyritic intrusive rocks. The eastern (5) mafic to intermediate metavolcanic sequence locally contains thin intercalated felsic units, which may be air fall ash though the local presence of apparent flaser structures is suggestive of subaqueous reworking. The central sequence is characterized by the presence within all lithologies of large blue quartz eyes, moderate to intense cataclastic features, primarily fluxion structure, and mafic stringers, clots, and bands formed as a result of segregation and/or intrusion.

An infolded sequence of epiclastic greywacke, locally conglomeratic, underlies the far northern portion of the map-area. Sills, dikes, and irregular bodies of gabbro-diorite have intruded both the metavolcanic and metasedimentary sequences.

A monzonite (to trondhjemite) complex is possibly present under the unnamed lake east of Beckington Lake and north of Queens Lake, as evidenced by several discordant and concordant intrusive dikes which cut the mafic to intermediate metavolcanic amphibolite sequence along the shoreline of this lake.

A granitoid gneiss terrain, apparently devoid of a border migmatite zone, underlies the eastern part of the map-area while the western granitoid area, consisting of both granodioritic and trondhjemitic gneisses and massive trondhjemite phases, locally has a border agmatite zone with the metavolcanic rocks.

The metamorphic grade changes from low to medium greenschist, to upper greenschist and almandine amphibolite facies south to north and is perhaps a reflection of a thinning of the metavolcanic-metasedimentary belt.

Structure: A regional foliation roughly parallels the distribution of the lithological units. It trends north in the south of the area, swinging approximately northwest in the north. Several small-scale fold structures with axial planes paralleling this foliation and with steeply plunging fold axes were seen. A younger crenulation foliation varies in strike from east to northeast, and the crenulation fold axes plunge moderately to steeply northeast (locally southwest) in the foliation plane. As mentioned above, the central lithological sequence in the northern portion of the map-area exhibits moderate to intense cataclastic structures which may represent the continuation of the major shear zone which extends along the Northeast Arm of Sturgeon Lake (Trowell 1973). Extensive faulting, indicated by displacement of lithological units, is only locally evident though several lineaments and zones of cataclasis are suggestive of faulting parallel to stratigraphy.

ECONOMIC GEOLOGY: Pyrite, pyrrhotite, and in a few places, minor chalcopyrite mineralization, generally less than 1 to 2 percent, occurs locally disseminated in the metavolcanic units. Magnetite grains, locally constituting upwards of 2 to 3 percent of a particular rock, locally occur within the volcanic clastic and volcanogenic metasedimentary rocks; they may be detrital in origin.

Several of the intermediate to felsic pyroclastic units exposed in the southern portion of the map-area contain clot-like or nodular concentrations of sulphide minerals, generally pyrite, that constitute up to 10 percent of the particular rock unit. The mineralized zones generally extend 5 to 10 feet (1.5 to 3 m) along strike and are 1 to 5 feet (0.3 to 1.5 m) wide.

The trenches and shafts found during the field survey were located on quartz $\pm$ carbonate veins and silicified breccia zones within the mafic to intermediate metavolcanic rocks. Presumably these showings had been examined for their possible gold content.

Diamond drill hole information that has been filed for assessment credit (Assessment Files Research Office, Ontario Division of Mines, Toronto) mentions several occurrences of sulphide mineralization, specifically: pyrite and pyrrhotite mineralization locally with minor chalcopyrite in the mafic metavolcanic amphibolites along the eastern portion of the Sturgeon Lake metavolcanic metasedimentary belt; graphitic sulphides (pyrite, pyrrhotite) zone, intersected in the metasedimentary sequence near Vanessa Lake, and local sulphide intersections in both mafic to intermediate and felsic to intermediate metavolcanics.

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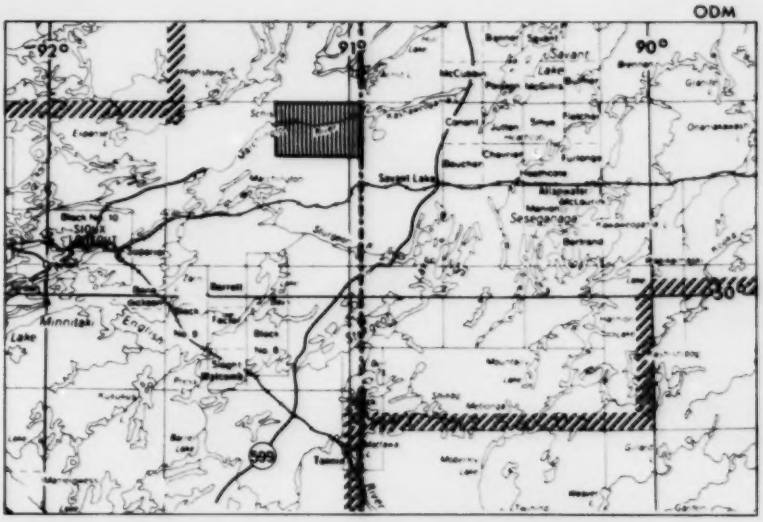
No.5 FARRINGTON LAKE AREA

DISTRICT OF KENORA

by

J.R. Trusler[1]

LOCATION: Farrington Lake is situated 10 miles (16 km) north and 15 miles (24 km) west of the Town of Savant Lake. Savant Lake is on the transcontinental line of Canadian National Railway and can also be reached by High-



LOCATION MAP Scale: 1 inch to 25 miles

way 599, which begins at Ignace on Highway 17, 80 miles (128 km) to the south. A float-plane base and a gravel landing strip are located 5 miles (8 km) southeast of the Town of Savant Lake.

The map-area is bounded by the 7th Base Line (Latitude 50°24'42"N) in the north and Latitude 50°18'00"N in the south. Longitude 91°15'00" is the western boundary of the map-area, and the eastern boundary coincides with the surveyed boundary between Thunder Bay and Kenora Districts. The enclosed area totals 96 square miles (250 km^2).

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The Marchington River provides good canoe access to the middle of the map-area, along an east-west line, and to the southeast corner via Farrington and Lewis Lakes. Several small isolated lakes in the southwest corner of the map-area are accessible by float equipped, fixed-wing aircraft. The northern boundary of the map-area is most readily reached from the Marchington River except in the northwest where Runway Lake provides good access.

A road is currently being planned which will connect Sioux Lookout and Highway 599 near Savant Lake. The surveyed route traverses the southern part of the map-area from west to east. The road will enter the map-area ¼ mile (0.8 km) north of the southwest corner, and will pass between Farrington and Lewis Lakes, exiting the eastern boundary 1¼ miles north of the southeast corner.

MINERAL EXPLORATION: The Savant Lake region has been prospected for precious metals since the turn of the century. Prior to 1965 only minor base metal exploration was undertaken, but the discovery of base metal deposits in the vicinity of Sturgeon Lake has spurred interest in the general area since 1968.

In the Farrington Lake area a few trenches in quartz veins remain as evidence of early exploration activity. More recently some companies have been engaged in airborne and ground geophysical prospecting, but assessment information is available for only five properties. No doubt the poor general access and the lack of detailed geological information have discouraged exploration activities.

In 1968, Canadian Nickel Company Limited held two claims on an island near the east end of Schist Lake. One airborne electromagnetic anomaly was tested by diamond drilling. The bore hole was drilled in siltstone, greywacke and tuffaceous metasediments to a length of 224 feet (68 m)*. Minor barren sulphides and graphite were both reported to be disseminated throughout the length of the core. The claims were allowed to lapse in 1970.

In 1969, a combined aerial electromagnetic and magnetic survey was performed for Canex Aerial Exploration Limited and was submitted as assessment on 48 claims within the present map-area. The claims were situated between the middle of the east side of Farrington Lake and the east boundary of the map-area. No significant anomalies were encountered*, no further assessment has been recorded, and all the claims have lapsed.

In 1970 and 1971, Noranda Exploration Company Limited assessed three claim blocks within the map-area. In all cases the ground was staked in coincidence with an aerial electromagnetic anomaly, and the work applied for assessment credit was ground electromagnetic and magnetic surveys. The first

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto.

property consisted of eight claims on the north shore of the Marchington River 1½ miles (2.4 km) east of Schist Lake. A Junior electromagnetic (J.E.M.) ground survey yielded only a hint of a long conductive axis, but a vertical loop electromagnetic (V.L.E.M.) survey outlined a definite east-trending conductor. An east-trending magnetic anomaly was defined 200 feet (61 m) south of the V.L.E.M. anomaly at the east end of the property. The two anomalies intersect each other 3/4 miles (1.2 km) to the west. The magnetic anomaly was interpreted to correspond to the contact of the metavolcanics and metasediments. The V.L.E.M. anomaly was attributed to a graphitic shear zone*. No further work was reported and the claims have since lapsed.

The second property consisted of two claims on the north shore of the Marchington River 2 miles (3.2 km) east of Farrington Lake. Ground V.L.E.M. and magnetic surveys failed to outline any anomalous zones*. No further work was reported and the claims have since lapsed.

The third property comprised four claims situated ½ mile (0.8 km) directly north of Drive Lake. Ground J.E.M. and magnetic surveys delineated one anomalous zone on the east boundary of the property*. Further work was recommended, but not since reported, and the claims have lapsed.

Mr. Roland Leblanc staked four claims 3 miles (4.8 km) east of Farrington Lake in September, 1973. To date no assessment work has been filed, but the claims remain in good standing.

GENERAL GEOLOGY: Previous regional mapping by Moore (1910 and 1928) and Skinner (1969) indicated that the area is underlain primarily by intermediate to felsic metavolcanics with local intercalated metasediments of Early Precambrian (Archean) age. Stratigraphically the rocks in the area can be subdivided into upper, and more extensive lower metavolcanic sequences.

The entire succession has been folded about a northeast-trending axis, and the present mapping program is centred on the west limb of this fold.

The oldest rocks in the map-area are exposed in a 7 mile (11 km) long, east-striking belt south of Farrington Lake, and are part of the lower metavolcanic sequence. These rocks are predominantly fine- to medium-grained, strongly foliated, mafic flows with minor associated pillow lavas and tuff. Intercalated with the mafic metavolcanics are some minor massive sandstones and greywackes. Remnants of the mafic metavolcanic sequence, including minor related ultramafic rocks, are evident as xenoliths and screens in the granitic sequence north of Schist Lake, the Marchington River and Fairchild Lake.

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto.

The central one-third of the map-area is underlain by the upper metavolcanic sequence. Four partial metavolcanic cycles of the basalt-andesite-rhyolite association were recognized in this sequence; however, folding may have produced some of the repetition here. Disregarding possible folding, the maximum thickness of the sequence is 17,000 feet (5,200 m) and the minimum thickness is 13,000 feet (4,000 m). The average thickness of individual units is 1,000 (300 m) to 2,000 feet (600 m). The metavolcanic sequence is largely truncated by a biotite granite stock which occupies the western one-third of the map-area.

The mafic metavolcanic units of the upper metavolcanic sequence are largely fine- to medium-grained chloritic flows, but mafic tuffs gradually become more prominant towards the western part of the map-area. Intermediate metavolcanics are mainly pyroclastic (70 percent), consisting of tuff and rarely lapilli-tuff; intrusive phases are common (20 percent), and flows relatively rare (10 percent). The felsic metavolcanics are predominantly tuffs (90 percent) with minor sills and dikes (10 percent). No felsic flows were recognized. Rhyodacitic to rhyolitic tuff extends from the east boundary of the map-area to at least 1 mile (1.6 km) west of Farrington Lake, and lies immediately north of the lower mafic metavolcanic sequence. The fragments are generally angular and felsic, but minor mafic fragments are present. Bond (1974) suggested a hypabyssal origin for this formation, but within the present map-area evidence indicates a pyroclastic origin. A felsic metavolcanic unit extends into the map-area from the east boundary 1½ miles (2.4 km) south of Fairchild Lake, and appears to pinch out on the west shore of Farrington Lake. Other smaller units of felsic pyroclastic rocks occur throughout the upper metavolcanic sequence.

A polymictic conglomerate is exposed along Fairchild Lake, the Marchington River and Schist Lake. The conglomerate is characterized by leucotrondhjemitic cobbles and boulders, and is continuous with the conglomerate described by Bond (1974). The conglomerate may be largely derived from the granitic rocks, and unconformably overlie them (Bond 1974), north of Schist Lake, the Marchington River and Fairchild Lake; however, the conglomerate and granite are separated by a fault throughout most of the map-area.

Two distinct metasedimentary units separated by a northern mafic metavolcanic unit occur south of the conglomerate. The more northerly unit ranges in thickness from 0 to 600 feet (180 m), is present at the eastern boundary and pinches out near the middle of the map-area. Cherty siltstone is always present immediately south of the conglomerate, and is succeeded southwards by variable quantities of banded siltstone, tuffaceous siltstone and subgreywacke.

The more southerly metasedimentary unit is 400 to 1,200 feet (120 to 360 m) thick, consists mainly of tuffaceous siltstone and reworked tuff, and is intercalated with felsic to intermediate pyroclastic rocks. Along the contact with the northern mafic metavolcanic unit, iron-bearing tuffaceous sediments 5 to 100 feet (1.5 to 30 m) thick are evident in several locations. To the west, this southern metasedimentary unit is largely composed of siltstones and greywackes with minor tuffaceous siltstones; it comes in direct contact with and is intercalated with the polymictic conglomerate. Rusty weathering carbonate beds are commonly found in association with tuffaceous horizons.

A large, elliptical shaped, gabbroic body, intrudes the lower mafic metavolcanic sequence east of Lewis Lake and is in contact with plutonic felsic intrusive rocks to the south. Quartz monzonite intrudes the interior of the gabbroic body, but no intrusive relationship was seen near the southern edge of the gabbro intrusion. The gabbroic pluton, with an average diameter of 2 miles (3.2 km), is generally differentiated; the western edge is composed largely of amphibolite, the middle of gabbro, and the east edge predominantly of diorite.

Felsic to intermediate intrusive rocks including trondhjemite, granodiorite, and quartz monzonite underlie the southeast, southwest and west-central parts of the map-area. A hornblende-biotite granite stock occurs in the western part of the map-area, separated from the granitic rocks to the south by a migmatized zone containing mafic inclusions from the lower mafic volcanic sequence. The upper metavolcanic sequence is truncated on the west by the granite stock, and a migmatitic zone 1 mile (1.6 km) wide occurs at the contact. No migmatization is evident on the north boundary of the stock , which extends west of the map-area.

A migmatitic granitic complex consisting of biotite and hornblende-biotite trondhjemite, granodiorite and quartz monzonite underlies the map-area north of Fairchild Lake, the Marchington River and Schist Lake.

STRUCTURE: The map-area is on the west limb of a large fold the axial trace of which is located 10 miles (16 km) to the east. The lithologic units have a gently curvalinear strike varying in trend from N80E to N85W within the map-area, and varying in dip from 75N to 75S.

Two axial plane cleavages are evident in the map-area: the younger trends at N50E; the older trends at N80E to N85W, being parallel in strike to the lithologic units. The younger cleavage parallels the axial plane of the large fold to the east, Bond (1972a; 1972b; 1972c; 1973). This latter period of folding resulted in many z-folds on the outcrop scale, and three areas of larger scale parasitic folding.

Deformation of the first period imparted the strongest foliation in the map-area, and formed isoclinal folds with horizontal hinge lines. Folding of this generation probably caused some of the repetition of lithologic units.

A dextral, east-trending strike-fault traverses the area separating the polymictic conglomerate from the granitic rocks to the north. Some small strike-faults parallel this trend immediately south of the conglomerate, but deformation attributed to this faulting is minor.

ECONOMIC GEOLOGY: Two trenches found near the south shore of Fairchild Lake and the Marchington River were excavated, apparently to assess secondary, discontinuous quartz veins. Quartz veins are numerous in the mafic metavolcanics on the Marchington River. The association of mafic flows, a continuous strike fault with some minor auxiliary faults, ferruginous and carbonate-bearing metasediments, and a granite intrusive make the area near Schist Lake and the Marchington River attractive for gold prospecting.

Disseminated barren sulphides appear ubiquitous in the map-area. Chalcopyrite was seen in scattered localities, but in only one place was it found in significant quantity. On the northeast side of the most easterly rapids in the Marchington River within the map-area minor local chalcopyrite with malachite and azurite were found by the author, and are associated with a subhorizontal shear in granite. Chalcopyrite occurs as disseminated crystals 0.5 cm in diameter in a fine-grained, biotite schist zone 3 feet (0.9 m) long, 1 foot (0.3 m) wide, and up to 1 inch (2.5 cm) thick within the granite. The matrix of the granite has no visible mineralization.

A small showing of weathered pyrite and pyrrhotite occurs at the end of a bay on the north side of the largest island in Schist Lake. The showing is severely weathered with a limonite gossan several feet thick. Approximately 20 percent barren sulphides were still visible. No chalcopyrite was visible, but a grab sample collected by the author was assayed by the Mineral Research Branch, Ontario Division of Mines, and contained: 0.08 percent Cu, trace Pb, trace Ag, and 0.01 ounce Au per ton. The host rock is tuffaceous metasediment. Diamond drilling by the Canadian Nickel Company Limited, previously noted herein under "Mineral Exploration", tested this horizon. Due to the general continuity of sedimentary units in the area, prospecting of this sulphide horizon along strike for copper-zinc mineralization may be worthwhile.

Approximately 1 percent disseminated pyrrhotite was found in the amphibolite phase of the gabbroic complex. The northwest and southwest edges of the complex appear to be the best areas for prospecting for copper-nickel mineralization.

Some ultramafic rocks were found in the northeast part of the map-area. Although enclosed by granite and not mineralized where examined, these rocks have apparently not been prospected before and may merit further scrutiny.

Felsic and intermediate metavolcanics are interrelated in the central part of the map-area and have not received attention in the past because of the thick cover of overburden (sometimes exceeding 100 feet (30 m)) and the

resultant low response to airborne prospecting, and also because of the previous lack of detailed geological maps. These areas should now be prospected on the ground using geochemical soil sampling or deep-penetration geophysical methods.

Sand and gravel deposits occur in a large northeast-trending esker-delta complex and in some terminal moraine south of Schist Lake. Sand is the major constituent, but some high grade gravel was seen locally by the author.

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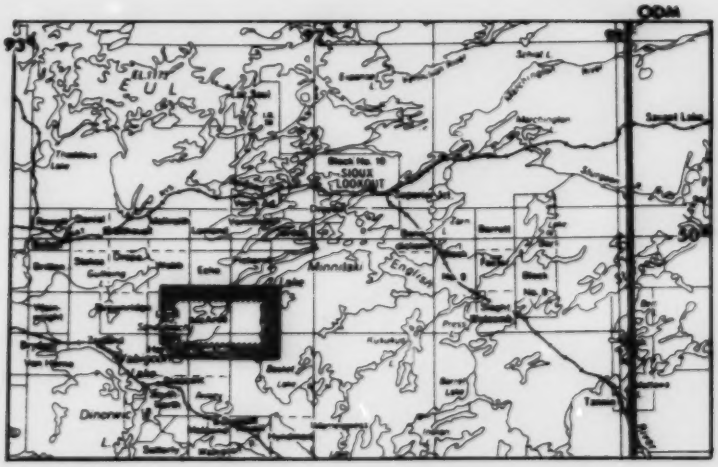
No.6 SANDYBEACH LAKE AREA

DISTRICT OF KENORA, PATRICIA PORTION

by

P.A. Palonen[1] and A.A. Speed[2]

LOCATION: The Sandybeach Lake map-area is bounded by Latitudes 49°45' and 49°54'N and by Longitudes 92°07'30" and 92°30'W, an area of approximately 180 square miles (466 km^2). The map-area includes McAree Township, parts of



LOCATION MAP Scale: 1 inch to 25 miles

Webb, Echo, Pickerel, Laval, Hartman, and MacFie Townships, as well as unsurveyed land in the southeast corner. Gravel roads provide access to Sandybeach Lake and Pickerel Arm from Highway 72 to Sioux Lookout. Field work was initiated on the project during 1974. Mapping of the southern half of McAree Township has been completed.

MINERAL EXPLORATION: Discovery of the Goldlund Mines Limited prospect in Echo Township in 1940 promoted significant gold exploration in the Sandybeach Lake Area. Although an intermittent extensive underground program of drifting

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[1]Resident Geologist, Ontario Ministry of Natural Resources, Sioux Lookout.

[2]Resident Geologist's Assistant, Ontario Ministry of Natural Resources, Sioux Lookout.

and drilling was conducted (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout) problems with delineation of ore zones lead to closure of the property short of production in 1973. Several other gold showings to the south and east of Sandybeach Lake are either patented or held in good standing. Drilling on most of these showings has failed to indicate mineralization of economic grade or volume (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout).

GENERAL GEOLOGY: The Sandybeach Lake map-area is underlain by a mafic metavolcanic sequence and a thick sequence of metamorphosed greywacke with minor conglomerate units all of Early Precambrian age. Granitic stocks penetrate the isoclinally folded metavolcanic and metasedimentary sequence.

Regionally, the Wabigoon metavolcanic-metasedimentary belt, which passes through the Sandybeach Lake area, has been subdivided into five units by Turner and Walker (1973). Outer boundaries of the belt are in contact with intrusive granitic masses. The five units are from north to south:

1. Northern Volcanic Belt
2. Northern Sedimentary Belt (Abram Group)
3. Central Volcanic Belt
4. Southern Sedimentary Belt (Minnitaki Group)
5. Southern Volcanic Group

The Sandybeach area is underlain mainly by the last three of these units. Present mapping has dealt only with the Southern Sedimentary Belt or Minnitaki Group (Walker and Pettijohn 1971), and the upper part of the Southern Volcanic Belt.

The upper half of the Southern Volcanic Belt has been mapped to the periphery of the Swimit Lake Stock and this section can be separated into three traceable units based on lithologic composition and internal structures. These units, commencing from the Swimit Lake Stock, are from bottom to top:

1. 1,300 feet (400 m) approximately: Mafic volcanic flows averaging over 160 feet (50 m) thick; medium- to coarse-grained.

2. 5,250 feet (1600 m) approximately: Mafic pillowed lava flows up to 30 feet (10 m) thick, few massive flows. Flows occasionally separated by felsic tuff units between 3 and 15 feet (1 and 5 m) thick.

3. 650+ feet (200+ m): Mafic flows up to 15 feet (5 m) thick, massive, fine-grained. Flows separated by felsic tuff units up to 30 feet (10 m) thick.

The contact between the upper mafic flows, unit 3, and overlying metasediments of the Minnitaki Group was not seen but is probably conformable.

The metasediments appear to conform to the stratigraphic sequence proposed for the Minnitaki Group by Walker and Pettijohn (1971) to the northeast of the map-area. A central granite-boulder conglomerate unit, can be traced southwest until the sedimentary fabric is obliterated by metamorphic effects of the Sandybeach Stock. Units above and below the conglomerate consist of fine-grained metamorphosed arkosic arenite.

Regional metamorphic grade is greenschist facies but approaching the Sandybeach Stock higher grade metamorphism is indicated in the metasediments by considerable biotite development and by garnet in the immediate contact zone.

The southwestern part of the map-area is underlain by a granitic intrusion consisting most commonly of hornblende-biotite granite, which is locally gneissic in appearance. Porphyritic phases also occur, containing phenocrysts and metacrysts of sodic plagioclase and potassic feldspar. The granitic rocks are generally pink in colour and locally white. Pegmatite and aplite dikes intrude the granitic body. Other granitic phases mapped include xenolithic, garnetiferous and muscovitic granite, as well as migmatite.

Structure: Although the gross regional structure has been reasonably well defined, (Hurst 1932), the detailed structure is more complex than would first appear. Intrusion of the granitic stocks has caused considerable secondary distortion and folding of the metasediments. Metavolcanics in the southern belt are virtually undeformed with little apparent stretching of clasts or pillows.

ECONOMIC GEOLOGY: Most of the felsic tuff units interbedded with the mafic metavolcanics of the Southern Volcanic Belt (Turner and Walker 1973) are thin but many contain minor (less than 1 percent) sulphide mineralization. Pyrite is common and several massive pyrrhotite bands up to 10 feet (3 m) thick have been exposed in road cuts along Highway 72. A grab sample of this material taken by the author assayed only traces of Ag, Pb, and Zn, and no Au or Cu (assays by Mineral Research Branch, Ontario Division of Mines).

Considerable pegmatitic material is associated with late-phase granitic stocks in the area, and although no showings are known within the map-area, several pegmatite related molybdenum occurrences (e.g. the properties of Rio Tinto Canadian Exploration Limited and Pidgeon Molybdenum Mines Limited), as well as cesium-lithium occurrences (e.g. the Kozowy-Leduchowski property) have been extensively tested to the southwest of the map-area (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout).

Several gold showings occur in the map-area associated with quartz veins in granodiorite sills radiating from the late-phase granitic stocks. Some of these showings were quite spectacular with visible gold reported (Chisholm 1951) from the outcrop and underground workings of the Goldlund Mines Limited

property. Gold in both the Goldlund Mines Limited prospect and the McCombe Mining and Exploration Limited prospect to the east of Sandybeach Lake is associated with galena and sphalerite or pyrite mineralization (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout).

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No.7 PIPESTONE LAKE AREA

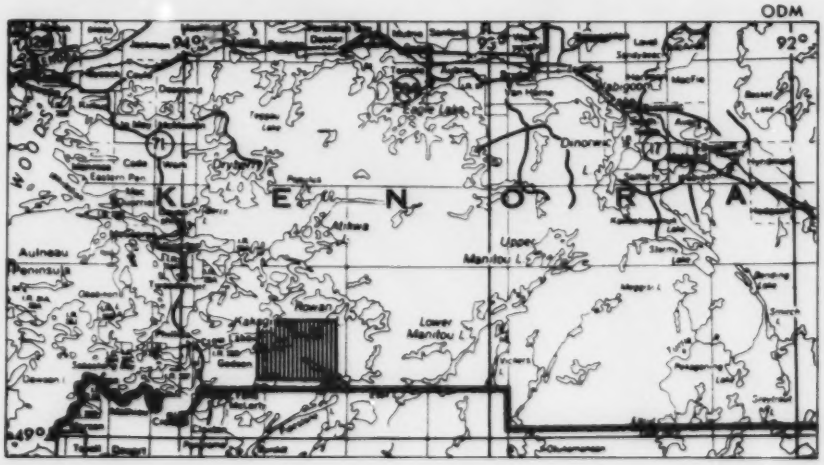
(NORTH PART)

DISTRICT OF KENORA

by

G.R. Edwards[1]

LOCATION: The northern part of the Pipestone Lake area bounded by Latitudes 49°07'30"N and 49°15'N and Longitudes 93°30'W and 93°45'W is centred approximately 14 miles (23 km) east-northeast of Nestor Falls, a small community midway between Kenora and Fort Frances on Highway 71.



LOCATION MAP Scale: 1 inch to 25 miles

Access is normally by float-equipped aircraft which may be chartered at Nestor Falls (also at Kenora, Dryden and Fort Frances).

Pipestone Lake is accessible by boat from the north end of Highway 615 on Burditt Lake, 28 miles (45 km) northwest of Fort Frances.

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MINERAL EXPLORATION: Exploration for gold appears to have begun in the last decade of the 19th century resulting in the discovery of numerous gold properties in adjacent areas.

A gold occurrence located on an island in the east central part of Kakagi Lake was originally sampled and trenched by Noranda Mines Limited in 1944 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). With the renewed interest in gold during the last three years, the occurrence has been restaked and is currently (October 5, 1974) held by Roy Martin (files of Mining Recorder, Ontario Ministry of Natural Resources, Kenora).

Major exploration for base metals was first undertaken in 1956 by Kennco Explorations (Canada) Limited. Two holes were diamond drilled totalling 752 feet (229 m), south of Tex Point at the east end of Kakagi Lake. (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Diamond drilling, subsequent to an airborne INPUT survey in 1967, was carried out by Selco Mining Corporation Limited in 1967 at the south end of South Otterskin Lake (two holes totalling 471 feet (143.6 m)) and in 1968 on Stanbury Lake (two holes totalling 401 feet (122.2 m)) (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Canadian Nickel Company Limited in 1969, diamond drilled at three locations a total footage of 1,027 feet (313.0 m). These were sited (1) between Brooks and South Otterskin Lakes, (2) south of eastern Kakagi Lake, and (3) south of Schistose Lake (Assessment Files Research Office, Ontario Division of Mines, Toronto).

In 1971 Amax Exploration, Incorporated explored a four claim group on the south shore of eastern Kakagi Lake using ground magnetic and electromagnetic surveys followed by geological ground work in 1973 (Assessment Files Research Office, Ontario Division of Mines, Toronto).

As part of a large scale combined operation by Freeport Canadian Exploration Company and Beth-Canada Mining Company in 1970, the Pipestone-Schistose Lakes area was flown using Mark VI INPUT airborne electromagnetic and magnetic equipment (Questor International Surveys Limited). Six conductors were selected and diamond drilled the following winter (Assessment Files Research Office, Ontario Division of Mines, Toronto).

The most recent diamond drilling in the area was done by Hudson Bay Oil and Gas Limited in 1973. Two holes were drilled on electromagnetic anomalies in the south bay of Cameron Lake. Total footage was 451 feet (137.5 m) (D.L. James, personal communication; Assessment Files Research Office, Ontario Division of Mines, Toronto).

During the summer of 1974, two new groups of claims were staked. One group consisting of 33 claims was staked by Hudson Bay Exploration and Development Company Limited south of Otterskin Lake. Seventeen claims were staked by Hudson Bay Oil and Gas Limited south of the most easterly extension of Kakagi Lake (Mining Recorder, Ontario Ministry of Natural Resources, Kenora).

Other claims in the area which remain in good standing as of Sept. 30, 1974 are those of the Roy Martin group (nine claims) on Kakagi Lake and two claims of the Freeport Canadian Exploration Company and Beth-Canada Mining Company group on Schistose Lake.

GENERAL GEOLOGY: With the exception of a northwest-trending diabase dike all bedrock in the area is of Early Precambrian (Archean) age.

Much of the northern Pipestone Lake area was described by Burwash (1933) and Thompson (1935) as part of a reconnaissance survey of larger adjacent areas. Goodwin (1965) included the northern Pipestone Lake area in a survey of regional proportions from which a broad synthesis of structure and lithologies was derived.

Recent detailed mapping in adjacent areas to the north and west was done by Kaye (1973, 1974), and Davies and Morin (1972). Some of the rock-units in these areas extend into the present map-area.

The map-area is divided into two sub-areas by a northwest-trending regional fault. Sub-area A comprises two-thirds of the map-area southwest of the fault, sub-area B comprises the remaining one-third.

Sub-Area A: A thick (15,000 feet) (4600 m) basal sequence of submarine mafic flows consists largely of pillowed, often variolitic, flow units interlayered with less abundant massive flows. The massive flows are sometimes coarse-grained and can be confused with gabbro and quartz gabbro sills which intrude the flows. Minor chert and flow-top breccias occasionally mark flow contacts. Small, intermediate pyroclastic units are restricted to the upper part of the sequence.

A shallow level quartz and quartz-feldspar porphyry stock intrudes the mafic flows southeast of Schistose Lake and appears to have formed an Early Precambrian (Archean) highland which was subsequently eroded.

To the north of and unconformably overlying the mafic flows and quartz porphyry is a thin band, 0 to 500 feet (0 to 150 m) thick, of basal breccia (regolith) and conglomerate and other minor, generally poorly sorted, finely to coarsely clastic metasediments. The contact between the mafic flows and these metasediments is generally either sheared or carbonatized, especially toward the east.

To the west, stratigraphically above the basal sediments, are 4,000 to 5,000 feet (1220 to 1520 m) of bedded tuff, tuffwacke and grey chert which grades into poorly bedded tuffwackes, and feldspathic wackes toward the centre of the map-area, and which, in turn, grade into poorly bedded, feldspathic wackes, intraformational chert breccia and minor pyrite-limonite iron formation on the east. This is overlain by 1,000 to 2,000 feet (305 to 610 m) of well bedded, finely to coarsely laminated greywacke, sandstone, and siltstone (northwest Pipestone Lake). Minor hematitic iron formation bands are included in this more distal sedimentary facies.

On Kakagi Lake, to a point just east of the centre of the map-area, the bedded pyroclastics grade northward from fine tuffs into coarse dacitic pyroclastic breccias which extend north and west out of the map-area.

A wedge of generally coarse mafic flows extends into the coarse pyroclastics between Shallow Water Lake and Kakagi Lake. These are similar in appearance to gabbro and were previously mapped as such but it was found that the body is in part amygdaloidal and occasionally exhibits pillow structure.

Ultramafic sills are restricted to the northwest corner of the map-area. Here, discrete, relatively fresh peridotite, pyroxenite, and gabbro sills intrude the coarse pyroclastics. Associated with these intrusions are lenses of leuco-gabbro, quartz gabbro, quartz diorite and amphibolite.

Quartz-bearing diabase, Middle to Late Precambrian in age, forms a 100- to 150-foot (30 to 46 m) wide dike which cuts all other formations and structures. This north-northwest trending dike can be traced with minor offsets for 56 miles (90 km).

Sub-Area B: This area is predominantly underlain by amygdaloidal and variolitic pillowed mafic flows with minor flow-top breccia, mafic tuff and lapilli-tuff, and interflow chert.

In the Otterskin Lake area, intermediate tuff-breccias are interbedded with the flows.

Gabbros are much less abundant northeast of the major fault. Instead, numerous thin felsite, aplite, fine-grained trondhjemite and occasionally quartz porphyry dikes dissect the flows.

Structure: The previously mentioned major regional fault divides the map-area into two distinct structural regimes.

Sub-area A represents the southwest limb of a postulated, broad, steeply plunging syncline the northeastern limb of which has been displaced by the regional fault leaving the present homoclinal structure.

The fault is characterized by sets of intense en echelon shears in a zone ranging in width from 200 feet (61 m) to 1,000 feet (300 m). Right handed strike slip has produced dragging and sets of conjugate shears on either side of the fault. Rocks in and adjacent to the major fault and its conjugate shears are often highly carbonatized.

A steeply dipping, east-trending, bifurcating fault zone located approximately along the centre of Kakagi Lake appears to separate a structurally simple section to the south from a complexly faulted section to the north. The ultramafic sills are concentrated in the portion north of the fault. Mafic flows which may be part of the basal sequence, have been dragged in along this fault.

Sub-area B appears to be dominated by a steeply plunging anticline, the axial trace of which lies along the centre of Brooks Lake and extends north-easterly along Brooks Creek.

ECONOMIC GEOLOGY: The map-area is of interest from the standpoint of gold exploration because:

(a) It is geologically similar to adjacent areas in which several gold occurrences are located.

(b) Gold occurs in the shear which extends east-west under Kakagi Lake (see "Mineral Exploration", Roy Martin property). The mineralized zone is restricted to a silicified shear containing minor pyrite and quartz veining 1¼ to 4 inches (2.5 to 10 cm) thick. Poor exposure hampers examination for strike length continuity but gold was found to be present in two pits 25 feet (8 m) apart (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). Quartz porphyry intrudes the metavolcanics adjacent to this zone.

(c) Carbonatizing fluids have been active especially in the flows and sediments in the eastern half of the map-area.

(d) Pipestone-Schistose Lakes volcanic sediments represent paleo-environment in which exhalite-type deposits could form. This environment is evidenced by the presence of thin but significant pyrite-limonite iron formation, chert and graphitic zones.

Exploration for base metals has, to date, not met with success. Several electromagnetic conductors diamond drilled by Kennco Explorations (Canada) Limited (1956), Selco Mining Corporation Limited (1967, 1968), Canadian Nickel Company Limited (1969), Freeport Canadian Exploration Company and Beth-Canada Mining Company (1971), and Hudson Bay Oil and Gas Limited (1973), have been pyrite and graphitic zones and to a lesser extent, pyrrhotite (Assessment Files Research Office, Ontario Division Mines, Toronto).

In general it appears that the conductors are stratabound, interbedded with the volcanic and volcanic derived sediments over considerable strike distances.

It is recommended that these zones be examined for mineralization facies changes which may lead to significant base metal accumulations.

The possibility of structurally controlled base metal deposits cannot be ruled out. The major fault which traverses the area should be investigated together with its conjugate shears.

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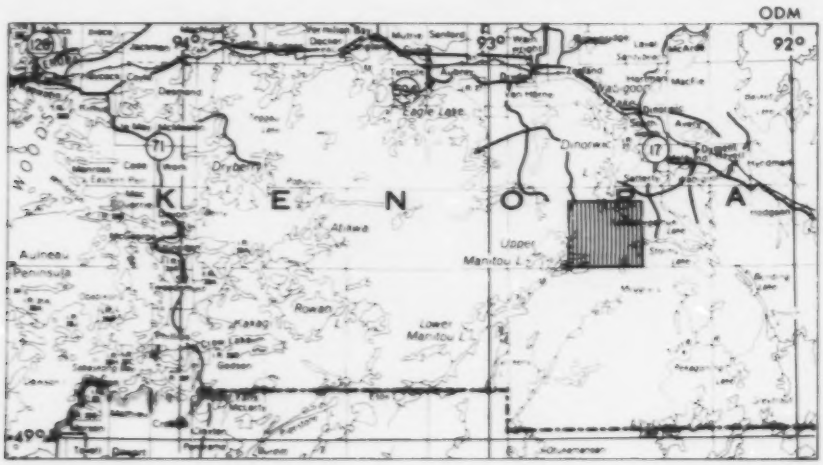
No.8 BOYER LAKE AREA

DISTRICT OF KENORA

by

C.E. Blackburn[1]

LOCATION: Boyer Lake lies about 25 miles (40 km) southeast of Dryden, in the District of Kenora. The map-area is bounded by Latitudes 49°22'30" and 49°30'N, and Longitudes 92°30' and 92°45'W, and covers approximately 100



LOCATION MAP Scale: 1 inch to 25 miles

square miles (260 km^2). Approximately 70 square miles (180 km^2) were mapped during the 1974 field season: the southeast portion of the area was not mapped.

No roads enter the map-area. The western portion of the area includes part of Upper Manitou Lake, which is accessible by lumber roads from Dryden. In the east, Boyer Lake can be reached via one portage from a logging road extending south from Highway 17 at Jackfish Lake.

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MINERAL EXPLORATION: Upper Manitou Lake and Lower Manitou Lake, which lie immediately west and southwest of the map-area, were the scene of considerable gold prospecting and mining activity during the period 1895 to 1912, and again in the 1930s (Thomson 1933; 1938). The former town of Goldrock lies within the map-area at the north end of Trafalgar Bay of Upper Manitou Lake. A number of gold mines and prospects were located adjacent to Trafalgar Bay; the only three to come to production were the Big Master, Laurentian, and Jubilee mines. The latter two mines owned by Elora Gold Mines Limited, closed down in 1938, while the Big Master Mine, owned by Kenwest Mines Limited with Dickenson Mines Limited holding a 60 percent interest, closed in 1948. During the period 1900 to 1948, a total production from these three mines of 12,078 ounces Au and 480 ounces Ag was recorded (data from Ferguson, Groen, and Haynes 1971). These figures represent total recorded production from the Goldrock camp.

A total of 62 patented claims are presently held on old gold properties in the vicinity of Trafalgar Bay. Among these are two large claims groups. Elora Gold Mines Limited holds a 10-claim block which includes the old Jubilee and Laurentian mines, and Kenwest Mines Limited holds a 35-claim block which includes the old Big Master Mine. During the 1974 field season, no work was being done on these claim groups.

In the southeast of the map-area, Pelham Gold Mines Limited holds a 17-claim block on a gold occurrence between Washeibemaga and Kennewapekko Lakes.

In September 1959, Massval Mines Limited diamond drilled two holes on a claim on the west side of Boyer Lake, and two holes on a claim at the north end of Walmsley Lake. All four holes were on the order of 400 feet (122 m) long. The four holes appear to have intersected the contact between the south side of a gabbro sill and mafic metavolcanics. Scattered pyrite mineralization occurred through all the sections. The highest copper value reportedly obtained on assay was 0.20 Cu over two feet (0.6 m) within the gabbro*.

In May 1965, 843 feet (257 m) of diamond drilling was done in five holes on the property of United New Fortune Mines Limited north of Kabagukski Lake. The holes reportedly intersected predominantly mafic metavolcanics, with minor rhyolitic bands. Assays yielded only traces of gold, and only minor amounts of pyrite, pyrrhotite, and chalcopyrite were noted scattered through the core*.

During the summer of 1967 and the following winter, Kerr Addison Mines Limited carried out ground electromagnetic surveys of seven groups of claims; only one of these lies within the present map-area. The six other groups

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto.

were discussed by Blackburn (1972, p.55; 1973, p.21; 1974a, p.140-143; 1974b). Eight conductors were located on the 24-claim group within the present map-area, which is located between Mountdew and Wolf Howl Lakes*. There is no record of drill holes having been put down to test these anomalies.

During the spring of 1970, a combined airborne electromagnetic and magnetic survey was flown by Questor International Surveys Limited for Freeport Canadian Exploration Company over Straw Lake (40 miles (64 km) southwest of the map-area), Eagle Lake (30 miles (48 km) northwest of the map-area), and Upper and Lower Manitou Lakes as a joint venture with Beth-Canada Mining Company. In the Upper and Lower Manitou Lakes part, electromagnetic conductors with attendant magnetic anomalies were found at six localities (Blackburn 1972, p.55; 1973, p.21; 1974a, p.131-132; 1974b) but at only one place in the present map-area, west of Trafalgar Bay, and at the extreme west edge of the map-area. There is no record of ground follow-up on this anomaly*.

In the winter of 1969-1970, Questor International Surveys Limited conducted an airborne electromagnetic-magnetic survey of a 180-square mile (466 km^2) area between Peak Lake in the west and Highway 17 in the east for Lynx-Canada Explorations Limited and Dejour Mines Limited. In the vicinity of Boyer Lake three, long, linear, east-trending conductors were detected by the airborne survey, in addition to a number of single and double line anomalies. During the summer of 1970, the geological consulting firm of Derry, Michener and Booth conducted a ground follow-up programme. In the Boyer Lake portion, geological mapping, electromagnetic and magnetic surveys, prospecting and trenching were carried out as ground follow-up. Pyrite, pyrrhotite, and minor chalcopyrite mineralization was discovered at the sheared north contact between a gabbro sill and mafic metavolcanics. Work in the area terminated in September, 1970 (Duncan R. Derry, personal communication).

In July of 1970, the Canadian Nickel Company Limited diamond drilled a 188-foot (57 m) hole at the northeast end of Kabagukski Lake. Graphitic zones alternating with rhyolite and agglomerate were reported, all of which carried scattered pyrite mineralization*. In August 1971, the same company diamond drilled a 325-foot (99 m) hole at the north end of Washeibemaga Lake, and in February 1972, a 467-foot (142 m) hole on an adjoining claim. Wide graphitic schist zones were encountered in both holes, with minor pyrite mineralization associated. Country rock was reportedly mafic metavolcanics and possibly mafic intrusive rocks*.

In February 1973, Questor International Surveys Limited conducted an airborne electromagnetic-magnetic survey between Boyer Lake in the southwest and south of Highway 17 in the northeast, for Underwood McLellan and Assoc-

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto.

iates Limited. Subsequently, 231 claims were staked, most of which belonged to a single block located over Boyer Lake*. Newmont Mining Corporation of Canada Limited conducted a ground follow-up programme on these claims during the summer of 1974.

During the summer of 1974, Hudson Bay Exploration and Development Company Limited continued geophysical and drilling activity in the Upper and Lower Manitou-Stormy Lakes area. Within the map-area, the diamond drilling of two holes was observed by the author on a four-claim group at the south end of Boyer Lake.

Drilling and geophysical work was done by Oja Limited during the summer of 1974 at Kabagukski Lake, Sasakwei Lake, and Mosher Bay of Upper Manitou Lake.

GENERAL GEOLOGY: The Boyer Lake area was previously mapped as part of a reconnaissance survey extending from Lower Manitou Lake to Stormy Lake, some 20 miles (32 km) to the east of Upper Manitou Lake, by Thomson (1933). The geology, as delineated by Thomson's survey, is incorporated in the Kenora-Fort Frances Compilation Map (Davies and Pryslak 1967). The present survey is part of a continuing programme of 1 inch to ¼ mile mapping of the Upper and Lower Manitou Lakes-Stormy Lake area, and adjoins, on its west side, the Upper Manitou Lake area, mapped during the 1973 field season (Blackburn 1973; 1974b).

The Upper and Lower Manitou Lakes-Stormy Lake metavolcanic-metasedimentary belt is arcuate in form, approximately 12 miles (19 km) in width, and some 50 miles (80 km) long tapering at either end, and joining on its north side with metavolcanics extending northward toward Dryden. Bedrock in the belt is of Early Precambrian (Archean) age, and consists of thick volcanic and sedimentary sequences intruded by porphyry dikes, granitic stocks, and gabbroic bodies. The belt is bordered by granitic rocks of batholithic domes. The present map-area is situated on the northern side of the belt, and entirely within it.

Within the map-area, the belt may be conveniently divided into two areas separated one from the other by the Manitou Straits fault, a major schist zone trending north-northeast and diagonally across the west part of the map-area. West of the fault bedrock consists of a lower sequence of predominantly coarse pyroclastics of intermediate composition and an upper sequence of mafic flows and pyroclastics. East of the fault the base of the sequence as exposed in the map-area is a 6,000-foot (1800 m) thick sequence of volcaniclastic and epiclastic rocks, the Manitou Series of Thomson (1933). Above it lies a thick mafic flow assemblage with one intercalated felsic unit. The assemblage is intruded by partly transgressive gabbroic sills. Metavolcanics and metasediments of both areas are intruded by numerous felsitic and porphyritic felsic dikes.

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto.

A granitic stock lies in the southeast portion of the map-area (Thomson 1933; Davies and Pryslak 1967) but was not mapped during the 1974 field season.

Revision of previous mapping includes the delineating of three gabbro sills that are extensions of gabbros mapped by Thomson (1933). At Boyer Lake a 2,000-foot (610 m) thick multiphase gabbroic sill has been mapped through the middle of the lake westward to Walmsley Lake over a distance of more than 5 miles (8 km), and is probably continuous with a second narrower sill lying to the north and parallel to it. A 5,000 feet (1500 m) thick gabbroic sill-like body outcrops north of Mountdew Lake and has been traced 4 miles (6.4 km) in an east direction from Selby Lake to its termination southwest of Wolf Howl Lake.

A felsic mixed flow and pyroclastic unit has been mapped eastward from the Manitou Straits Fault from north of Kabagukski Lake via Walmsley Creek, and possibly to the north end of Walmsley Lake.

Structural Geology: The north-northeast trending Manitou Straits Fault defines the boundary between two structurally distinct as well as stratigraphically distinct areas. West of the fault, the lower and upper sequences occupy a tight, steeply northeast-plunging anticline, the Manitou Anticline (Goodwin 1970). Strong planar and linear deformation of all bedrock in this area is indicated by a penetrative, ubiquitous, northeast-trending, vertical foliation.

East of the Manitou Straits Fault the mafic volcanic sequence appears to have been folded about an east-west axial plane that is intersected to the west by the fault. The basal volcaniclastic-epiclastic sequence is exposed on the southern limb of this fold only, and has not been repeated within the map-area by folding. In contrast to the area west of the Manitou Straits Fault, strong penetrative deformation is absent in this area.

ECONOMIC GEOLOGY: Gold occurrences in the Upper and Lower Manitou Lakes area have, in the past, been interpreted as being associated with felsic dikes and quartz veins that intrude the metavolcanic-metasedimentary pile (Thomson 1933; 1936; 1938). The present map-area includes the portion of the Manitou gold field that proved to be the richest producer of gold, namely that around Trafalgar Bay. In addition to the Big Master, Laurentian, and Jubilee mines there were many prospects and occurrences that did not reach the production stage. In the map-area these include the Detola, Giant, Last Chance, Little Master, Big Dick, Paymaster, Selby Lake and Victory prospects and occurrences. All are discussed by Thomson (1933; 1938).

Minor amounts of chalcopyrite have been detected in association with the 2,000 foot (610 m) thick, east-trending gabbroic sill at Boyer Lake. The mineralization was observed in two localities, one on the south contact

of the sill, by Massval Mines Limited*, and one on the north contact by Derry, Michener and Booth (Duncan R. Derry, personal communication). Airborne electromagnetic surveys have delineated conductive zones parallel to and closely associated with gabbro-mafic metavolcanic contacts, both for the southern sill and the northern sill*. Other conductive zones parallel the sills, but lie within the mafic metavolcanics. If the sills are differentiated bodies, they are good targets for exploration for cumulate copper deposits. The eight conductive zones delineated by Kerr Addison Mines Limited during ground electromagnetic survey of their 24-claim group between Mountdew Lake and Wolf Howl Lake lie parallel to and closely associated with the southern contact of the Mountdew Lake gabbro sill with mafic metavolcanics*. A magnetic anomaly, in excess of 60,900 gammas, is centred over the Mountdew Lake sill (ODM-GSC 1961) but no strong anomalies accompany the Boyer Lake sills. Magnetic attraction of the compass was detected in the Mountdew Lake sill, and a small amount of massive magnetite was found at one locality on the north side of the sill.

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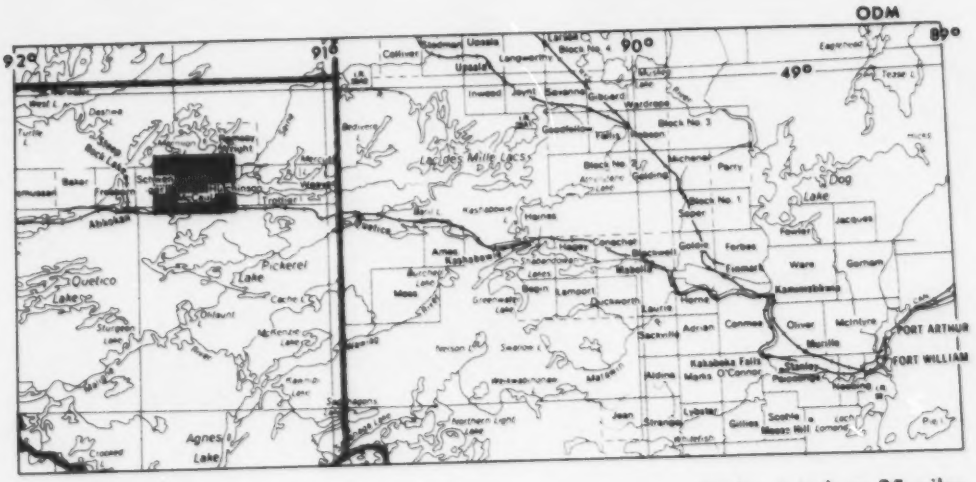
No.9 WEST HALF OF SAPAWE LAKE AREA

DISTRICT OF RAINY RIVER

by

W.H. McIlwaine[1] and E.M. Hillary[2]

INTRODUCTION: Mapping of the Sapawe Lake area started in 1973 (McIlwaine and Chorlton 1973). In 1974, the authors mapped the west half of the assigned area comprising the eastern half of Schwenger Township, the western three-



LOCATION MAP

Scale: 1 inch to 25 miles

quarters of McCaul Township and adjacent unsurveyed territory to the north and south. The area is about 110 miles (177 km) west of Thunder Bay and about 6 miles (9.6 km) east of Atikokan. Previous mapping was done by Hawley (1929).

MINERAL EXPLORATION: Mineral exploration in the area has been concentrated mainly in the region south of Plateau Lake, along the metavolcanic belt, and to a lesser extent in the granitic batholith adjacent to the metavolcanic rocks.

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(a) South of Plateau Lake: In 1948 Duvay Gold Mines Limited held a block of 27 claims which stretched south of Nym Lake. Work by the company included geological mapping and a magnetic survey. Minor pyrite and chalcopyrite were mentioned in the assessment report by Helens (1948).

In this same general region Northern Canada Mines Limited held 18 claims, also in 1948. A magnetic survey was conducted and the results submitted for assessment credit.

In 1973, R. Thew examined old pits and shafts in a small pyroxenite body; the body and adjacent metasedimentary rocks were examined by ground electromagentic and magnetic surveys plus one diamond drill hole which was entirely in the metasedimentary rocks. The hole was 84 feet (25.6 m) long (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

(b) Metavolcanic belt: North of Olcott station, Andowan Mines Limited held a group of 10 claims in 1948. A report on file at the Regional Geologist's office in Thunder Bay mentions two short diamond drill holes totalling 32.5 feet (9.9 m) put down by previous owners.

In 1970, Kemins Explorations Limited flew magnetic and electromagnetic surveys over most of the metavolcanic belt to delineate targets for exploration. No further work has been reported.

(c) Granitic rocks north of the metavolcanic belt: M. Wicheruk put down four diamond drill holes for assessment credit, near the powerline south of the Rawn Reservoir. These holes totalled 356 feet (108 m) and were all in granitic rock. No mineralization was reported.

Almada Explorations Limited put down four diamond drill holes at the southeast corner of Singleton Lake in 1967 to test for gold mineralization. The holes totalled 1,029 feet (313.8 m) and were entirely in granitic rocks.

GENERAL GEOLOGY: The bedrock is entirely Early Precambrian in age and the geology is similar to that in the eastern half of the map-area described by McIlwaine and Chorlton (1973). Three major units are present: an east-trending metavolcanic belt, a parallel metasedimentary belt, and granitic batholiths. The metavolcanics and metasediments are separated by the Quetico Fault.

The metavolcanic belt is dominantly intermediate to mafic in composition and is composed mainly of fine- to medium-grained massive flows. Numerous subvolcanic gabbroic sills occur throughout the pile. The belt extends 6 miles (9.6 km) east-west across the map-area and is up to 8,000 feet (2440 m) wide. The southern 1,000-foot (300 m) section is composed predominantly of felsic flows and pyroclastic rocks.

The southern margin of the metavolcanic belt is characterized by a zone of metamorphosed sulphide facies iron formation. This iron formation, which forms part of the Atikokan iron range, is discontinuous along its strike length and is up to 340 feet (100 m) wide.

Immediately to the south is the metasedimentary belt; this is composed mainly of greywacke. The greywacke grades southward into a quartz-biotite schist towards the margins of a granitic batholith. Locally sericite schist occurs near the Quetico fault zone.

Intruding the metasedimentary rocks are small ultramafic bodies composed mainly of pyroxenite and hornblendite (Larsen 1974). These intrusions vary greatly in texture and are commonly very coarse-grained.

The age relationship between the two granitic batholiths is not known because they are separated by the supracrustal rocks and, therefore, are not seen in contact. In the southern batholith an early, fine-grained, grey, equigranular biotite granodiorite to quartz-monzonite phase is apparently followed by a medium-grained equigranular to porphyritic, biotite-muscovite granite to quartz-monzonite. This latter is the most abundant phase. Late stage pegmatite dikes, with local tourmaline, cut the previous phases. The contact zone is characterized by numerous xenoliths and infolded zones of metasediments. Locally the rock becomes a mappable migmatitic unit.

North of the supracrustal rocks is the Marmion Lake Batholith (Fenwick 1972) of which the southern margin occurs in the map-area. The batholith is a metamorphosed high level intrusion which is composed mainly of fine- to medium-grained, biotite-chlorite trondhjemite and quartz diorite. Later phases, occurring as small discrete plutons are composed of granodiorite and quartz monzonite. These small plutons are evident in the Marmion Lake, Lower Seine Lake area. They are generally more coarse-grained than the earlier phases. Aplite and pegmatite dikes occur locally but not as commonly as in the southern batholith. Complex hybrid zones with abundant xenoliths occur within the batholith. The contact zone does not appear as complex as to the east (McIlwaine and Chorlton 1973); xenoliths are common but the contact is more easily defined.

Structural Geology: The dominant structural feature of the area is the Quetico Fault which separates the metavolcanic belt from the metasedimentary belt. Although no direct evidence for the fault was found by the authors the strong topographic linear feature, essentially the Atikokan River, and description of the fault by other authors (Shklanka 1972; Irvine 1963; Kaye 1967) in adjacent areas gives some support to its existence. Other faulting in a northeasterly direction is evident, this is especially so along the west shore of Lower Seine Lake where local shearing was found.

Metamorphic foliation in the supracrustal rocks generally trends east-northeast and dips steeply. A similar direction of foliation is developed in the southern granitic batholith; this is most evident in the contact zone.

Bedding in the metasedimentary rocks was found locally, and is parallel to sub-parallel to the foliation. Unfortunately the detection of bedding is often a function of cleanliness of the weathered surface; on the lichen covered outcrops in the area this detection becomes difficult.

ECONOMIC GEOLOGY:

Gold: Gold deposits have been found in the Marmion Lake Batholith; most of these, including the Sapawe Gold Mine (now under lease to Atiko Gold Mines Limited), are east of the map-area (McIlwaine and Chorlton 1973; Hawley 1929). These deposits are in quartz veins in the contact zone with the metavolcanics, and in the batholith itself in localized shear zones.

Diamond drilling in the metavolcanic rocks by Andowan Mines Limited, north of Olcott station, returned gold values up to 0.61 ounce per ton over 2.5 feet (76 cm) (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). The mineralization was in quartz veins.

Iron: Iron deposits of the area comprise lenticular bodies of metamorphosed, sulphide facies iron formation which occurs along the southern edge of the metavolcanic belt in or near the Quetico fault; these are described by Hawley (1929). The main minerals found in the iron formation include pyrite, pyrrhotite, chalcopyrite and magnetite.

Sulphides: Disseminated pyrite and lesser amounts of chalcopyrite were found locally in the metavolcanics. Pyrite and chalcopyrite were reported in logs of diamond drill holes by Almada Explorations Limited at the southeast corner of Singleton Lake. One of these logs also reported finely disseminated molybdenite over 12 feet (3.6 m) (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

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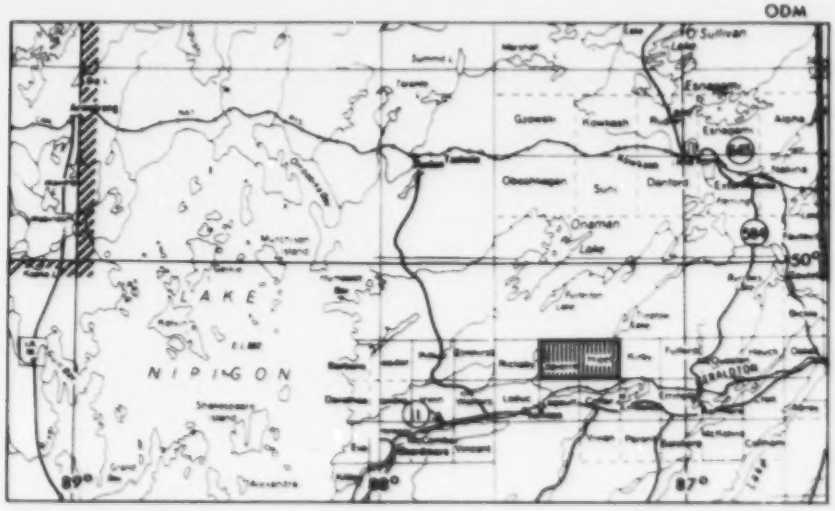
No.10 LAPIERRE AND HIPEL TOWNSHIPS

DISTRICT OF THUNDER BAY

by

W.O. Mackasey[1]

LOCATION: Lapierre and Hipel Townships are located on the east side of Lake Nipigon and form part of the "Sturgeon River Gold Belt". The southwestern part of the map-area is approximately 8 miles (13 km) by road from the settlement of Jellicoe. The City of Thunder Bay lies to the southwest, a distance of approximately 146 miles (235 km) by road. Highway 11 (The Trans-Canada Northern Route), a line of the Canadian National Railway and a natural-gas pipeline pass through the adjacent townships to the south of the map-area. A series of logging roads and trails provide excellent access to Lapierre Township. There are no roads and only a few trails in Hipel Township. Access to this township is best provided by float-equipped aircraft via Dumas Lake or Tigerlily Lake. A float-plane base and a compacted gravel airstrip are located at Jellicoe. Accommodation, fuel and supplies are available at Jellicoe, as well as, the nearby Towns of Geraldton and Beardmore.



LOCATION MAP Scale: 1 inch to 25 miles

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[1]Central Archean Subsection Leader, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

MINERAL EXPLORATION: Between December 1971 and March 1972, Hudson Bay Exploration and Development Company Limited conducted a ground exploration program in the Geraldton-Beardmore area to follow up targets outlined by airborne geophysical surveys. Two blocks of claims, comprising 21 claims in the southwest corner of Lapierre Township and 34 claims extending from Delisle Lake in Lapierre Township east to about ½ mile (0.8 km) within Hipel Township, were investigated by horizontal loop electromagnetic surveys. Two diamond drill holes, totalling 750 feet (229 m) were put down in the western group and six holes, totalling 1,876 feet (572 m) were completed in the eastern group (Assessment Files Research Office, Ontario Division of Mines, Toronto). The drill holes intersected mineralization consisting of narrow stringers and veins of graphitic pyrrhotite and pyrite with trace amounts of chalcopyrite. No further work was done and the claims have been allowed to lapse.

In September and October 1971 two X-ray diamond drill holes totalling 325 feet (99 m) were completed by Canadian Nickel Company Limited near the northwest corner of Delisle Lake, Lapierre Township (Assessment Files Research Office, Ontario Division of Mines, Toronto). This work was undertaken on a group of nine unsurveyed claims covering an area northwest of Delisle Lake. The holes intersected metavolcanic rocks with mineralized zones of variable amounts of pyrrhotite, pyrite and graphite. No further information is available and the claims have since been dropped.

In 1972 Amax Exploration, Incorporated carried out a ground exploration program to study the economic potential of seven claim groups located north of Jellicoe that had been staked on the basis of an airborne magnetic and electromagnetic survey. Two of these claim groups were located within the map-area. A block of four claims termed the Atigogama Group and located in northwestern Lapierre Township underwent geological mapping, and geochemical, ground electromagnetic and magnetic surveys. According to reports on file with the Assessment Files Research Office, Ontario Division of Mines, Toronto, ground work failed to locate any economic materials and the airborne electromagnetic anomaly is thought to have been caused by surficial effects. The second block termed the Lapierre Group which consisted of 15 unsurveyed claims in southwestern Lapierre Township were explored in the same manner as the Atigogama Group. Three diamond drill holes totalling 1,175 feet (358 m) were put down in January of 1973 to test targets outlined by the geophysical work. All holes intersected pyrrhotite and pyrite mineralization and/or graphite. No further work was recommended for this claim group (Assessment Files Research Office, Ontario Division of Mines, Toronto). In the course of the work done by Amax Exploration, Incorporated a drill hole collar, estimated to be 2 to 3 years old, was located close to one of the electromagnetic conductive zones. No records on this drill hole are available.

In 1972, D. Thorsteinson located a copper occurrence a few hundred feet southeast of Atigogama Lake, Lapierre Township. Several test pits were blasted and a limited amount of trenching completed. No further work has been done and the ground is open to staking.

In 1973, B. Nelson held four unsurveyed claims in the vicinity of Dumas Creek in southern Hipel Township. A test pit in mafic metavolcanics was located by the field party that exposed quartz stringers and veins containing minor amounts of chalcopyrite. No other work appears to have been done and the claims have been allowed to lapse.

A single, unsurveyed claim was held by A. Lafontaine in the west-central part of Lapierre Township in 1973. Evidence of some surface work, including test pits were found in rusty schistose metavolcanics that contained minor amounts of sulphides. This claim has since been cancelled.

GENERAL GEOLOGY: The map-area is underlain by Early Precambrian (Archean) metavolcanics and granitic rocks. The metavolcanics consist of an assemblage of mafic, massive, amygdaloidal and pillowed flows with intercalated pillow breccia, lapilli-tuff, thin-bedded to laminated tuff and tuffaceous metasediments. These rocks are overlain by pyroclastic rocks of intermediate composition and minor dacitic flows. This succession is intruded by a porphyritic granodioritic pluton having 2 to 3 cm potassium feldspar phenocrysts. This pluton underlies much of Hipel Township and is the southwest-extending lobe of a large granitic batholith lying to the north of the map-area. North-trending Late Precambrian (Keweenawan) diabase dikes cut all other rock types. A thick veneer of boulder till and glaciofluvial gravel is present in Hipel and parts of Lapierre Townships.

Structural Geology: The metavolcanics in Lapierre Township form the south half of the nose of a broad, west-plunging syncline. This part of the fold is well exposed in Lapierre Township with layered volcanic units being tracable for several hundreds of feet. Tops were determined by pillows. The northern part of this syncline has been mapped by Moorhouse (1938).

ECONOMIC GEOLOGY: Several occurrences of graphitic sulphides consisting of pyrrhotite and pyrite have been encountered by diamond drilling beneath a drift covered area near the southern boundary of the map-area as previously listed under the Mineral Exploration section. These occurrences lie along an east-west line and may be related to an extensive fault or shear zone.

The occurrence located a few hundred feet southeast of Atigogama Lake in Lapierre Township by D. Thorsteinson consists of a network of chalcopyrite-bearing quartz-carbonate stringers in siliceous metavolcanics. These stringers also cut a nearby diabase dike, thus suggesting the mineralization is as young as Late Precambrian age. This mineralization may be related to the extension of a north-northeast trending fault mapped by the author (Mackasey 1969) in Leduc Township and thus be fault controlled.

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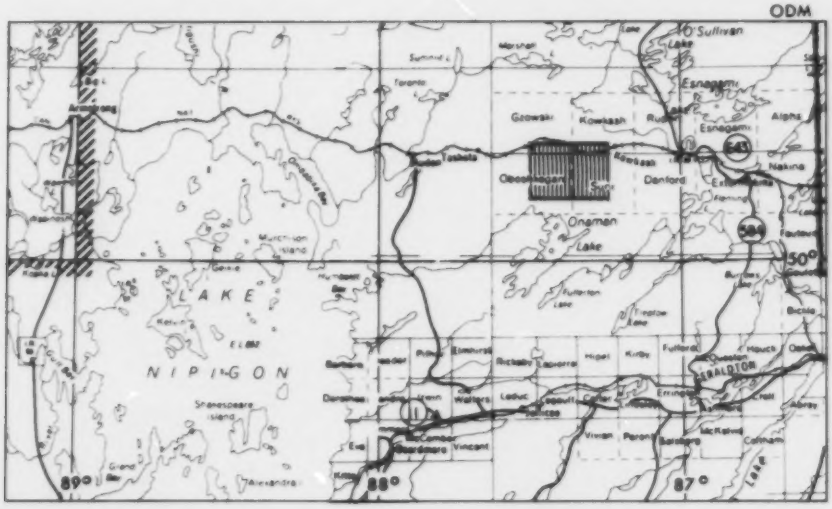
No.11 GLEDHILL LAKE AREA

DISTRICT OF THUNDER BAY

by

S.E. Amukun[1]

LOCATION: The Gledhill Lake map-area is located 35 miles (56 km) north of the settlement of Jellicoe, and about 40 miles (64 km) northwest of the town of Geraldton. Kowkash station, on the Canadian National Railway trans-



LOCATION MAP Scale: 1 inch to 25 miles

continental line, and situated 1 mile (1.6 km) outside the eastern boundary (northeast portion) of the map-area, is about 155 air miles (249 km) northeast of the City of Thunder Bay.

The map-area covers an area of approximately 100 square miles (260 km^2), being bounded by Latitudes 50°07'30" and 50°15'00"N, and Longitudes 87°15'00" and 87°30'00"W.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

Access to the area is by small float-equipped aircraft, which can be chartered from Jellicoe, Geraldton or Nakina. Alternatively, the map-area can be reached by rail via the Canadian National railway which crosses the northern section of the area. The central eastern protion can also be reached by an all weather access road from Nakina via Kowkash. Most of the waterways including: Red Paint (Onaman) Creek and the lake-system it drains, Johnson Creek, Jeffries Creek, and parts of Castor Creek are navigable at high water levels. An old bush road (now only a trail) connects the old Suni station and Jeffries Lake, via Sandhill Lake. A system of new diamond drill roads connects Louis, Castor, Odikon and Indigo Lakes to the old road.

MINERAL EXPLORATION: The Onaman iron ranges of this district were first located and examined about the year 1904, when survey crews of the National Transcontinental Railway (Canadian National Railway) started the survey of the railway line through this region (Moore 1908; 1909). In 1906 and 1907, iron prospects were discovered and staked by R.H. Flaherty Syndicate (Maple Leaf, Height of Land, Winter Camp and Miller prospects) and by M.C. Bain (Moore 1908; 1909). Discovery of the iron prospects led to a rush by prospectors into the area, and a provincial government geologist (Moore 1908; 1909) was sent to study the deposits. Moore (1908; 1909) described the iron formation in detail and subdivided the deposits into the north, central and southern ranges. In 1906 and 1907, the prospects were extensively stripped, trenched and sampled; in 1906, the Winter Camp and Miller prospects were tested for R.H. Flaherty Syndicate by two diamond drill holes totalling 490 feet (149 m)*. The results are not available but were apparently discouraging because exploration work on the Onaman iron ranges was suspended and remained dormant despite the completion of the railway through this area in 1913 (Hopkins 1916; 1917). However, the Onaman iron ranges were mapped by Ontario Department of Mines geologists in varying detail viz.: Hopkins (1916; 1917), Gledhill (1925) and Kindle (1931). In 1951 Kennco Explorations (Canada) Limited conducted an airborne magnetometer survey over a large area that included the Onaman iron range country (M.W. Bartley, (1958), assessment files); in October 1952 the same company acquired property in the southern and central ranges and conducted magnetic and geological surveys followed by other surveys (electromagnetic and magnetic) with no apparent significant success. By summer of 1953, Canadian Cliffs Limited had acquired ground covering most of the iron deposits of the northern range by staking and by optioning the Peterson and MacLeod-Fikis claims. The company initiated vertical-field ground magnetic, and geological surveys which were conducted on their behalf by Bartley, Greer and Associates of Port Arthur. No further work was reported. In the summer 1953, Bartley, Greer and Associates also carried out a vertical field magnetic survey on the R.K. Rohmer (T. Christianson) claims, and recommended several diamond drill holes. In 1956, Technical Managers Incorporated diamond drilled six holes totalling 2,045 feet (623.3 m) on their claims near the railway east of Suni station*. In 1957, Can-Fer

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto, and Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay.

Mines Limited acquired 24 of the original 96 claims optioned to Canadian Cliffs Limited in the northern iron range and also obtained results of Kennco Explorations (Canada) Limited airborne magnetometer survey of the area. Additional claims (106) were staked in the centre of Suni Township (southern and central ranges) and in the vicinity of Sandhill and Jeffries Lakes. A number of groups of claims were also optioned and subsequently purchased in the central and southern ranges viz.: Gustafson option (40 claims), Smestad-Minoletti option (24 claims), Cavell Lake option (47 claims) and Isaacs group (22 claims). Can-Fer Mines Limited then initiated a program of geophysical (magnetometer and gravity) and geological surveys on its total holdings. These surveys were followed by detailed diamond drilling and surface work (open pits and trenches). Following the completion of this work, two deposits of beneficiating iron ore (35,604,000 long tons) were outlined as the Jeffries and west-central ore bodies (Bartley, Greer and Associates*). Potential ore of 69,375,000 long tons, available by underground mining, was estimated by Bartley, Greer and Associates*. Extensive metallurgical testing was then conducted. The Can-Fer Mines Limited property is now on option to The Algoma Steel Corporation Limited until July 31, 2064. In 1967, The Algoma Steel Corporation Limited conducted diamond drilling on the Can-Fer Mines Limited option. Six holes totalling 2,198 feet (670 m) were drilled*.

In recent years, several major exploration companies (Noranda Exploration Company Limited, Imperial Oil Limited, Icon Syndicate, Phelps Dodge Corporation of Canada Limited, Canadian Nickel Company Limited) have carried out exploration programs including airborne magnetic-electromagnetic surveys, ground geophysical follow-up and geological mapping in search of gold and base metals. A few of the above surveys culminated in limited diamond drill programs*. During the 1974 field season, Noranda Exploration Company Limited was conducting geological-geophysical check-up surveys on their ground near Oboshkegan and Castor Lakes and Icon Syndicate carried out an extensive diamond drilling program over isolated areas within the map-area. This program failed to outline valuable ore minerals other than pyrite, pyrrhotite and graphite (A.J. Troop and R. Desjardins, Icon Syndicate (1974), personal communication).

GENERAL GEOLOGY: Previous studies in parts of the map-area by Moore (1908; 1909), Hopkins (1916; 1917), Gledhill (1925), and Kindle (1931) were mostly of reconnaissance nature. Many of the rock-units outlined by detailed mapping of the North Onaman area (eastern half) immediately to the south (Thurston et al. 1973), and the Tashota area immediately to the west (Amukun 1974) extend into the current map-area.

The consolidated rocks underlying the area comprise an Early Precambrian (Archean) metavolcanic-metasedimentary and gabbroic assemblage bordered and intruded by granitic bodies. Swarms of Middle to Late Precambrian (Proterozoic) diabase dikes intrude the older rocks.

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*Information from: Assessment Files Research Office, Ontario Division of Mines, Toronto, and Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay.

Metavolcanics form about 60 percent of the map-area and range in composition from mafic (44 to 50 percent SiO_2) to felsic (61 to 74 percent SiO_2) types. The mafic metavolcanics, forming 30 percent of the map-area outcrop as two broad bands, each about 1 mile (1.6 km) wide, which strike east across the map-area; they are composed of massive, pillowed, amygdaloidal/vesicular and schistose units. Zones of altered (carbonatized, chloritized and sheared), porphyritic and recrystallized mafic metavolcanics are also present. Mafic to intermediate (51 to 60 percent SiO_2) metavolcanics are rare and do not form a mappable unit, but are admixed with the mafic and felsic types.

Felsic metavolcanics covering 30 percent of the map-area, are composed predominantly of pyroclastic units ranging in texture from tuff to pyroclastic (coarse) breccia. The felsic metavolcanic unit is locally overlain conformably by a group of interlayered rocks consisting of thin beds of chert, jasper, ash tuff, tuffite, feldspathic sandstone, siltstone, slate, graphitic argillite and chlorite schist with which the iron formation of the Onaman iron ranges is associated. These metasediments outcrop over 10 percent of the map-area and are located around the north part of Gledhill Lake.

Iron formation outcrops are thin-bedded, being composed of 1 to 6 inches (2.5 to 15 cm) thick laminae of magnetite, chert, and jasper and is closely associated with thin beds of metasediments and metavolcanics. Three bands of iron formation were mapped, these are located: (1) south of Jeffries Lake (Moore's southern range); (2) north of Indigo Lake and east of Castor Lake (central range); and (3) south and east of Wilgar Lake (Moore's northern range).

The metavolcanics and metasediments are intruded by dikes and sills of gabbro, diorite and lamprophyre, that predated the granitic emplacement.

A stock of medium- to coarse-grained, well foliated, potasium-poor granitic gneiss ranging in composition from trondhjemite to granodiorite occurs around Suni Lake. This stock is intruded by a boss of biotite-hornblende quartz monzonite. A smaller but similar body of hornblende quartz monzonite outcrops northwest of Gledhill Lake. The granitic rocks constitute 30 percent of the map-area.

Late diabase dikes postdated the granitic intrusions and cross-cut all other rocks in the area. These dikes form conspicuous ridges and nearly always contain magnetic minerals.

Structure: The regional structural trend in the metavolcanics, metasediments, iron formation and granitic gneisses is generally east-west and is defined by well developed metamorphic and cataclastic foliation and mineral lineation. However, in detail, the structure cannot be interpreted because of the lack of essential-structural information. A few reliable top determinations are confined to cross-beds, graded beds and pillow facings. These structures

indicate the presence of one or possibly more antiform-synform pairs within the metavolcanic-metasedimentary belt. Minor folds are common in the iron formation. There are a number of northwesterly striking major faults and/or shears.

ECONOMIC GEOLOGY: The majority of the old exploration surveys had been conducted in order to evaluate the extent and hence economic potential of the magnetite in the iron formation bands within the Onaman iron ranges. Previous surface exploratory surveys by Can-Fer Mines Limited on the central iron range, including open pits, geophysics-geology, diamond drilling and extensive metallurgical testing, located two zones of potential open-pit beneficiating iron viz.: The Jeffries deposit located in a zone 800 by 3,200 feet (244 by 975 m) including an island of waste 300 by 1,300 feet (91 by 396 m); to a depth of 360 feet (110 m), the deposit was estimated by Bartley, Greer and Associates* to contain 28,537,000 long tons of potential iron ore with an average grade of 29.24 percent soluble iron. The west deposit was estimated by Bartley, Greer and Associates* to contain 7,067,000 long tons of potential iron ore having an average grade of 29.64 percent soluble iron. These two estimates by Bartley, Greer and Associates represent total probable ore reserves, available by open-pit mining, of 35,604,000 long tons with an average grade of 29.45 percent soluble iron. It is estimated by Bartley, Greer and Associates* that an additional 69,375,000 long tons of potential iron ore are available by lateral mining (32,313,000 long tons) from the low points of the pits, and by conventional underground mining (37,062,000 long tons) to the 1,000-foot (305 m) level*.

Grab samples from a few untested gossan zones within the sericite schists derived from felsic pyroclastic breccia, located about 2.5 miles (4 km) northwest of Nixon Lake were collected by the field party and submitted for assay by the Mineral Research Branch, Ontario Division of Mines. The samples returned only trace to minor values of Cu, Ni and no values of Pb, Zn and Sn.

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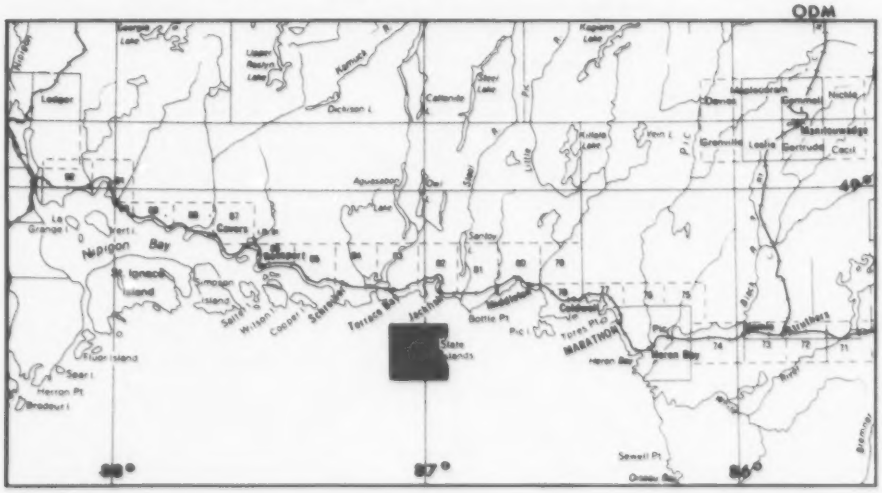
No.12 GEOLOGY OF THE SLATE ISLANDS

DISTRICT OF THUNDER BAY

by

R.P. Sage[1]

INTRODUCTION: The Slate Islands are comprised of a group of 17 islands and islets located at approximately 48°39'30"N Latitude and 87°00'00"W Longitude. The islands, covering an estimated area of 15 square miles (39 km^2), are



LOCATION MAP Scale: 1 inch to 25 miles

located in the northeast corner of Lake Superior, 7 miles (11 km) south of the townsite of Terrace Bay.

Geologic field work on the islands was carried out by a party of 5 men from May 23 to August 15. Mapping of the south coastline of Patterson Island from just west of Horace Cove to "Southeast Harbour" located due west of Cove Island and most of the interior traversing of Mortimer and Patterson Islands was done by Mr. Keith Treacher. Mapping in the Lawrence Bay area was by Mr. D. Meloche. Mapping of the east, north, and west coasts of Patterson Island, the coastline of Mortimer Island, and all outlying islands was by the author.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

Access: The Slate Islands can be reached by boat from Terrace Bay which lies on the Trans Canada Highway 17.

A large segment of the coastline of the islands is rugged and can be safely examined only in calm weather. The ruggedness of the coastline of Patterson Island is largely a function of extensive diking and selective erosion of the various schists away from the dikes. On Mortimer Island selective erosion of shear zones has contributed to the formation of its precipitous shore. The interiors of the islands are locally broken by walls, pinnacles and spires of rock largely of diabase composition.

GENERAL GEOLOGY: The Slate Islands consist mainly of Early Precambrian (Archean) metavolcanics.

The southeast corner of Patterson Island is characterized by felsic volcanic breccias of rhyolitic to dacitic composition. Moving west and north from this general area felsic pyroclastic deposits become increasingly mixed with volcanic clastic slump deposits of predominantly felsic composition. Minor quantities of siltstone-argillite are intercalated with the felsic metavolcanics at Sunday Harbour, and at William Point metasediments derived from felsic volcanic detritus are present.

Minor quantities of banded iron formation occur as distinct units within the felsic metavolcanics of the island. These units consist of red to grey jasper bands interbedded with black magnetite and hematite. The iron content is relatively low and the iron formation grades into laminated chert.

Mafic metavolcanics occur along the northeast-projecting peninsula of Patterson Island on the west side of Lawrence Bay. They also occur within the west-central portion of the island, striking northwest, and on the eastern half of the island trending northeast.

Mortimer Island is composed predominantly of massive, pillowed, and flow brecciated mafic metavolcanics with minor interbeds of argillite. A unit of interbedded arkose and argillite occurs at Barnard Point on the southwest tip of Mortimer Island.

Delaute Island consists mainly of a sequence of massive and pillowed mafic metavolcanics with local thin zones of well laminated, light greenish-grey chert.

Francois Island consists of mafic pyroclastic rocks intruded by a mafic to ultramafic body along its southeast side.

Dupuis Island is largely composed of felsic metavolcanics and their derived schists, with mafic metavolcanics along the northwest side.

Bowes Island consists of felsic pyroclastic rocks and derived sericite schists. McColl Island which lies to the west of Bowes Island is largely felsic in composition with minor, more mafic units, along the north and west sides.

Edmonds Island, which lies west of McColl Island, is composed of predominantly amygdaloidal mafic metavolcanics and dioritic intrusive rocks.

Excluding Spar Island, the Leadman Islands consist of feldspar-rich amygdaloidal flow rocks. Spar Island consists of sericite schists most likely derived from felsic volcanic rocks.

Patterson Island metavolcanics have been intruded by feldspar and quartz-feldspar porphyries, some of which contain more than 50 percent feldspar phenocrysts. Most of the porphyritic felsic intrusive rocks are schistose; however, more massive and possibly younger quartz-feldspar porphyry intrusions were noted 1) midway up the east coast of Patterson Island, and; 2) northwest of and east of Horace Point. Similar more massive quartz feldspar porphyries occur on the outlying reefs on the east side of Leadman Islands.

Mafic intrusive rocks of dioritic composition are abundant along the northeast projecting arm of land on the west side of Lawrence Bay, Patterson Island, and on Edmonds Island. These intrusive rocks also form some of the hills within the interior part of Patterson Island. The southeast corner of Mortimer Island is the site of a dioritic intrusion and a number of the massive rather homogenous units mapped as volcanic on Mortimer Island and Delaute Island are in all probability intrusive. On Edmonds Island evidence was observed for two possible ages of Early Precambrian intrusive activity of dioritic composition.

Ultramafic rocks were noted on the south side of Francois Island and along the southwest coast of Mortimer Island.

Along the west side of Patterson Island a unit of interbedded argillite, chert, and hematite-chert carbonate occurs beneath the Keweenawan, and overlying the Early Precambrian rocks. This unit may be equivalent to the Gunflint Formation (J.M. Franklin, Lakehead University 1974, personal communication).

The overlying Keweenawan rocks consist of massive to amygdaloidal mafic volcanics with thin (less than 1 m) interbeds of red siltstone and sandstone. The Keweenawan is intruded by diabase, cut by breccia dikes and has locally been sheared and moderately folded. The exposed Keweenawan is about 400 feet (120 m) thick; 16 flow units were identified and more are undoubtedly present. The metavolcanics, and at least one of the sandstone beds, have a well developed cone-shaped or plumose fracture pattern (shatter-cone-like) which is well displayed on several wave washed shoals along the west coast of the island. The axes of these shatter-cone-like features have a shallow eastward plunge with their apices showing a strongly preferred orientation towards the east.

The Keweenawan volcanic and sedimentary rocks and the Early Precambrian rocks are cut by numerous diabase sills and dikes. The thickest and largest exposures of diabase dikes occur on the south side of Patterson Island, particularly in the vicinity of the Slate Islands lighthouse.

On Spar Island and in several spots along the northeast corner of Patterson Island, and in one location on the northwest corner of Patterson Island, mafic syenitic dikes, thought to be equivalent in age to the Port Coldwell alkalic intrusive complex, were noted. In general, these dikes are small (less than 30 feet (10 m) wide) and irregular in nature.

Diatreme structures or megabreccias occur in two locations along the west coast between the Early Precambrian and Keweenawan sequences: on reefs north of Cove Island; and possibly in the first cove west of the three islands at the southeast corner of Patterson Island. These rocks occur as anastomosing dikes of breccia which cut all rock types found on the islands including the mafic syenites. The clasts are angular to subrounded, up to 12 by 12 feet (4 by 4 m) in size and are set in a grey-green to brick-red ground mass of comminuted rock. Breccia diking is abundant along the west, south, and east coasts of Patterson Island and can often be observed on calm days, beneath shallow lake waters along the east coast in the early spring. Fairbairn et al. (1959) reported K-Ar and Rb-Sr ages of 1065 million years on biotites from nepheline syenites and 1225 million years (Rb-Sr) from the perthites of the laurvikite of the Port Coldwell alkalic complex. If the mafic syenite dikes of the Slate Islands are equivalent in age to the Port Coldwell complex, then the breccia-forming event occurred no more than about 1,000 million years ago.

Schistosities on the east coast of Patterson Island appear to parallel the primary bedding, however, along the west coast schistosities appear to cut primary bedding at rather high angles. Schistosities on Bowes Island are generally east-trending while those on Edmonds and McColl Islands are north-trending. The channels between the various islands are probably zones of faulting. Patterson Island is a fold structure, the exact nature of which is unclear.

The Early Precambrian rocks of the islands have been metamorphosed to the greenschist facies rank of regional metamorphism. The Keweenawan rocks appear relatively fresh but have also been metamorphosed to zeolite or lower greenschist facies.

GEOCHEMICAL SURVEY: As a part of the mineral potential evaluation of the Slate Islands, 91 stream sediments were collected by the geological survey party during the course of bedrock mapping. All sampled material was shipped to the Mineral Research Branch Laboratory, Ontario Division of Mines, Toronto for sample preparation and chemical analysis. The stream sediments were oven dried at 80°C and sieved through an 80 mesh stainless-steel Tyler screen. The -80 mesh fraction of the samples was analyzed for hot HNO_3-HCl

screen. The -80 mesh fraction of the samples was analyzed for hot HNO_3-HCl extractable Cu, Pb, Zn, Co, Ni, Mn, Fe, As, and Ag. Results will be integrated by G. Closs[1] with geological mapping data.

ECONOMIC GEOLOGY: The earliest record of prospecting activity on the islands was recorded by Bow (1899). He mentioned that considerable prospecting was in progress on the islands and that some discoveries had been made.

Bow (1901) stated that in 1900 prospection on the islands had been in progress for 2 to 3 years and that mining had been in progress since December 1899. The islands were owned by Lieutenant-governor J.C. Patterson of Manitoba at the time of this work. Two tunnels were driven at lake level, 400 feet (120 m) apart, on the northwest corner of "South Slate Island" [Patterson Island] (Bow 1901). The tunnels were briefly examined by members of this party. The south adit (No. 1) measured 25 feet (7.5 m) and the north adit (No. 2) measured 166 feet (51 m) in length with a short 5 foot (1.5 m) cross cut. The work on this property undoubtedly ceased shortly after the visit by Bow (1901). Both adits were collared in narrow (approximately 1 m) bands of brecciated, banded chert.

Coleman (1902) visited the islands to investigate reports of iron deposits occurring on the islands but did not find iron deposits of economic merit, however, he published the first brief geological report of the islands.

Parsons (1918) investigated the gold potential of the islands and reported that "South Slate Island" [Patterson Island] had a remarkable quartz vein development which he described at 10 different locations. Parsons (1918, p.164,166) described a quartz vein on the west side of "St. Mary's Bay" [Horace Cove] as the most promising showing and reported that this vein contained visible gold, was 4 to 8 inches (10 to 20 cm) in width, and had a strike length of 400 feet (120 m). Because of a lack of time no attempt was made by members of this party to locate the veins described by Parsons (1918).

A tunnel driven by person(s) unknown is located on the east side of Copper Harbour. This tunnel was driven at lake level on a sulphide showing and was reported by Parsons (1918) to have been driven to test a copper showing. The sulphide zone (on which the adit was driven) appears to cut through the hill and outcrop on the south side of the bay in the northeast corner of Copper Harbour. At this point the sulphide zone is 50 feet (15 m) in width and consists of disseminated to almost massive pyrite.

The adit was briefly examined by members of this party: the opening is 60 feet (18 m) long and has a waterfilled winze 10 feet (3 m) deep at its terminus. A trace of bluish-green staining may indicate traces of copper being present, however, no other indication of interesting mineralization was observed.

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[1]Geochemist, Geophysics/Geochemistry Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

From 1960 to 1963 Kimberly-Clark of Canada Limited conducted an exploration program on the islands searching mostly for gold mineralization on Patterson Island (G.L. Puttock[1] 1974, personal communication). During 1960 Canadian Aero Service Limited conducted an airborne electromagnetic and aeromagnetic survey of the islands for the company (Puttock 1974, personal communication). The following years (1961 and 1962) considerable effort was spent in trenching, bulldozing, and sampling quartz veins on the northwest side of Horace Cove (formerly St. Mary's Bay) and on a second showing known as the Cosen's Occurrence located approximately 800 feet (240 m) northeast of the St. Mary's Bay zone (Puttock 1974, personal communication). The first occurrence is located in the position of Parsons (1918) "F" vein which was considered by him to be the most promising.

In 1963 a diamond drilling program was completed by Kimberly-Clark of Canada Limited on the St. Mary's zone. This program consisted of 20 holes totalling an estimated 6,581 feet (2006 m) (Puttock 1974, personal communication). This work located numerous narrow (less than 3 to 4 inches) (7.5 to 10 cm) quartz veins of limited strike-length carrying variable gold values. Assays exceeding 1 ounce per ton over widths of 1 or 2 inches (2.5 cm to 5.0 cm) were not uncommon (Puttock 1974, personal communication). The narrow widths, short strike length, and highly variable values discouraged additional work at that time.

Minor amounts of asbestos fibre were located by the field party along the sheared contact of an ultramafic intrusion and mafic pyroclastic rock on the south side of Francois Island.

Minor amounts of chalcocite were noted in some of the carbonate veins cutting the Keweenawan rocks on the west side of Patterson Island.

Disseminated sulphides are not uncommon on the islands particularly in the felsic metavolcanic rocks in the southeast corner of Patterson Island where some schists are spotted with oxidized pyrite. Some massive pyrite float with traces of chalcopyrite occurs on the beach of Patterson Island west of Cove Island.

Recommendations for the Prospector: The gold showings on Horace Cove and within the interior of the island warrant a re-examination, particularly in light of present gold prices.

The islands warrant a second airborne geophysical examination and a close inspection of their base metal potential. The widespread occurrence of disseminated sulphide in the felsic metavolcanics would suggest that the rocks are highly favourable for the occurrence of sulphide mineralization.

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[1]President, Kimberly-Clark of Canada Limited.

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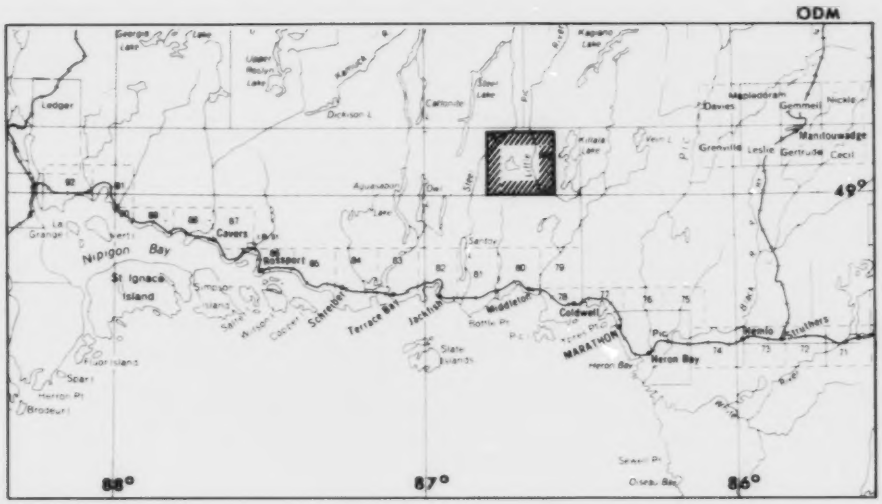
No.13 CARBONATITE-ALKALIC COMPLEXES

by

R.P. Sage[1]

During the past field season a project to map and evaluate the known carbonatite-alkalic complexes within the Province was begun. The Prairie Lake carbonatite complex was selected to be the first intrusion studied



LOCATION MAP

Scale: 1 inch to 25 miles

during this program. Initial mapping of the complex was confined to trenches dug by Newmont Mining Corporation of Canada Limited and the general surface geology remains to be completed during the forthcoming field season. Plans to map the Killala Lake alkalic rock complex were not initiated during the past field season.

PRAIRIE LAKE COMPLEX: The complex is located on the northwest side of Prairie Lake at approximately 49°02'00"N Latitude and 86°43'00"W Longitude. The general circular shape of the intrusive body is prominently displayed in ODM-GSC Aeromagnetic Map 2148G.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

Preliminary investigation by this field party would suggest that the complex is composed of alternating concentric or arcuate zones of ijolite (rock composed dominantly of nepheline plus pyroxene) and carbonatite rock.

Exploration History: During 1969 Newmont Mining Corporation of Canada Limited completed 15 diamond drill holes for a total of 1,550 feet (472 m) (Assessment Files Research Office, Ontario Division of Mines, Toronto).

The company has excavated several trenches along the southern margin of the complex and has completed geochemical surveys, scintillometer surveys, magnetometer surveys, geological surveys and mineralogical studies on the body (private files, Newmont Mining Corporation of Canada Ltd.). This work has disclosed local areas of uranium-niobium mineralization.

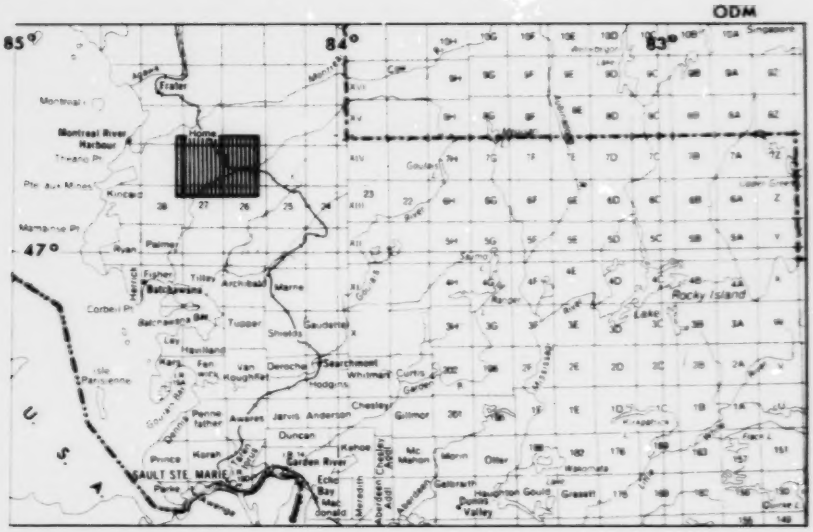
No.14 BATCHAWANA-PANGIS AREA (WEST HALF)

DISTRICT OF ALGOMA

by

G.M. Siragusa[1]

LOCATION AND ACCESS: The map-area is bounded by Latitudes 47°07'30" and 47°15'N and by Longitudes 34°15' and 84°30'W. It includes the Township of Tolmonen (formerly Township 27 Range 14), most of Tronsen Township (formerly Township 26 Range 14), the northern parts of Norberg and Olsen Townships (formerly Township 27 Range 13 and Township 26 Range 13, respectively), southern parts of Home Township and Raaflaub Township (formerly Township 26 Range 15), an eastern strip of Smilsky Township (formerly Township 28 Range 14), and the northeastern and southeastern corners of Nicolet Township (formerly Township 28 Range 13) and Peever Township (formerly Township 28 Range 15) respectively, for a total of approximately 100 square miles (260 km^2).



LOCATION MAP Scale: 1 inch to 25 miles

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

A dirt road connects Highway 17 with the Tribag Mine in Nicolet Township (formerly Township 28 Range 13), and with Batchawana Station in the central part of Tronsen Township (formerly Township 26 Range 14). From Batchawana Station the road extends eastward crossing the Mongoose-Wart Lakes area of Vibert Township (formerly Township 25 Range 14) and connects further east with the Chapleau-Thessalon Highway 129. Within the map-area this road crosses the Little Batchawana River and the Batchawana River on two log bridges which, in the early summer of 1974, were in poor condition. Another bush road connects the Big Pike Lake area with Highway 17 via the Montreal River road thus giving access to the northern part of the map-area. In addition, many old bush roads occur in the area as a result of logging during the past 25 years, but most of these are overgrown and offer little practical means of access. The Algoma Central Railway crosses Tronsen Township (formerly Township 26 Range 14) and the northeastern corner of Tolmonen Township (formerly Township 27 Range 14); Batchawana Station and Rand Lake are flag-stop points for passenger trains. Although several lakes are scattered throughout the area they are mostly of small size and only Big Pike, Patterson, Mitchell, and Carpenter Lakes and to a lesser extent Rand Lake, are normally used as access points by float-equipped aircraft.

ODM Geological Map No. 35b (Moore 1926), and the Batchewana-Hubert sheet of the Algoma Central Railway geological map (Algoma Central Railway 1964), cover the whole area at the scale of 1 inch to 2 miles, and 1 inch to 1 mile, respectively; ODM Preliminary Maps P.359 (Giblin 1966) and P.363 (Armburst 1966) cover the northern parts of Norberg Township (formerly Township 27 Range 13) and Olsen Township (formerly Township 26 Range 13) at a scale of 1 inch to ½ mile.

MINERAL EXPLORATION: Most of the map-area was covered by an airborne magnetometer survey carried out by Jalore Mining Company, Limited in 1953*. Between 1962 and 1963 detailed geophysical surveys and geological mapping at the scale of 1 inch to 200 feet were carried out by the Algoma Ore Division of The Algoma Steel Corporation Limited at various localities in Tronsen Township. The only recorded development work that followed this activity was a 401-foot (122 m) diamond drill hole at one of these localities*.

GENERAL GEOLOGY: The western half of the map-area is underlain by granitic rocks extending uninterruptedly from the southwestern to the northern boundary of the area. These rocks vary in composition from quartz monzonite to trondhjemite, the more potassic phases being generally either massive or less pronouncedly gneissic than the sodic ones. The granitic rocks contain biotite as the dominant mafic component, are locally migmatitic owing to the presence of xenoliths of supracrustal rocks, and magnetite nodules may occur within their pegmatitic phases. In the southeastern corner of Tolmonen Township

*Assessment Work Files, Algoma Central Railway, Division of Lands and Forests, Sault Ste. Marie.

(formerly Township 27 Range 14) and along a segment of the Batchawana River approximately 3 miles (5 km) long, the granitic rocks are in fault contact with a northeast-trending metavolcanic-metasedimentary sequence having an estimated thickness of 4,500 feet (1,370 m) and dipping steeply to the northwest. The northern part of this sequence is essentially metasedimentary and consists primarily of quartz-plagioclase-biotite schists and paragneisses carrying occasional thin bands of staurolite-biotite schist. Associated with these rocks are subordinate amounts of aphanitic felsic metavolcanics, felsic metasiltstone, probably derived from reworking of felsic metavolcanics, and lesser trondhjemite sheets which are mostly concordant and are locally cataclastic in texture. Close to the southern boundary of the area these rocks give place along strike to mafic metavolcanics consisting of fine- to medium-grained, strongly foliated chlorite-hornblende schist. The southern part of the sequence consists dominantly of mafic metavolcanics containing occasional metasedimentary horizons and occasional small intrusions of gabbro and ultramafic rocks. South of the prominent north-pointing turn of the Batchawana River in southeastern Tolmonen Township (formerly Township 27 Range 14) the metavolcanic-metasedimentary sequence is truncated by a body of pegmatitic quartz monzonite approximately 1 mile (1.6 km) wide, which separates the sequence from the prominent occurrences of supracrustal rocks found in the eastern half of the map-area.

The eastern half of the map-area is almost entirely underlain by metasediments and subordinate mafic metavolcanics. Mafic metavolcanics form an arcuate belt having an estimated thickness of about 5,000 feet (1,500 m) and a length of approximately 4.5 miles (7.2 km). This belt extends in a NNE through NNW and NW direction, from the southwestern boundary of the area to a locality approximately 1 mile (1.6 km) west of the eastern boundary of Tolmonen Township (formerly Township 27 Range 14), where it is in fault contact with the granitic rocks. The mafic metavolcanics of this belt dip to the east and northeast, and are flanked to the west by the granitic rocks of Tolmonen Township; to the east and to the north they are in contact with metasediments which underlie most of Tronsen Township (formerly Township 26 Range 14), extend beyond the boundaries of the area, and are folded into a major synclinal structure (see "Structural Geology" section). Medium- to fine-grained quartz-plagioclase-biotite schist and paragneiss with interbeds of staurolite-biotite schist containing up to 15 or 20 percent staurolite are dominant in the axial area and northern limb of the syncline; felsic metasiltstone with subordinate interbeds of felsic metavolcanics and lesser iron formation bands are found in the southern limb of the structure. The rocks of the northern limb are in contact to the northeast with mafic metavolcanics extending outside the northern boundary of the area, and to the east with a body of quartz monzonite extending outside the eastern boundary of the area. The southern limb of the syncline has been intruded by a tonalitic and dioritic body which, within the area, outcrops over approximately 2 square miles (5 km^2). Although this intrusion has an overall homogeneous character it contains up to 20 percent combined hornblende and biotite which is not a primary feature but has resulted from contamination as indicated by partly assimilated mafic xenoliths of large size observed in a few outcrops.

Northwest-trending diabase dikes up to at least 250 feet (76 m) in thickness are widespread and typically form many of the vertical cliffs and hill tops of this very rugged area. Some northeast- to north-trending dikes are also present. Diabase dikes are the youngest rocks found in the area, and cut all the previously mentioned rocks.

Structural Geology: Except for one outcrop of much flattened and distorted pillowed mafic metavolcanics found just outside the map-area, no evidence of primary structures was seen in the metavolcanics.

Three cross-bedded outcrops with tops to the NE are shown by an assessment work map* in the Mitchell Lake area in Tronsen Township.

Metamorphic foliation is well developed in the metavolcanics and in the metasediments where it is seen to parallel bedding; it is moderately to well developed in the trondhjemitic to granodioritic rocks and in places is absent in quartz monzonite.

Faulting has already been mentioned in relation to geological contacts (see "General Geology" section). The metasediments in the northern part of Tronsen Township strike ENE and dip to the south and those in the south-central part of the Township strike ESE and dip to the north. These data and the outcrop pattern of the metasediments in the central part of the map-area indicate the presence of a major east-trending and east-plunging syncline, the axial trace of which lies very close, and parallel to the northern shore of Patterson Lake.

ECONOMIC GEOLOGY: Rusty stains resulting from oxidation of minor pyrite disseminations were locally observed in mafic metavolcanics and metasediments during the 1974 field work. The Batchewana-Hubert sheet (Algoma Central Railway 1964) shows occurrences of pyrite in rusty or shear zones at five localities in the map-area, chalcopyrite in rusty zones at two other localities, and molybdenum in a quartz vein at an eighth locality. These occurrences were not located by the field party and no data on the amount of mineralization, host rocks, and development work (if any) were found in assessment records. The same map shows an occurrence (No. 36 on the map) of pyrite and copper in the southwestern corner of Tronsen Township. This is the site of a 401 foot (122 m) diamond drill hole drilled by Algoma Central Railway (see "Mineral Exploration" section) which intersected a 155 foot (47 m) sequence of "...grey schists of probable metasedimentary origin" containing zones of small pyrite lenses in amounts up to 5 percent semi-massive pyrite-pyrrhotite over a 2 foot (0.6 m) thickness, and traces of chalcopyrite over a thickness of 5 feet (1.5 m). Assays from this hole returned only low values for copper and nickel and no values for gold and silver*.

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*Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie.

Assessment work filed by Harold O. Seigel & Associates, Limited for Franc. R. Joubin & Associates, Limited for work done in 1962 indicates the presence of a narrow band of magnetite iron formation striking approximately east, with a strike length of at least 5,200 feet (1584 m) in the Carpenter Lake area, and a band of the same type, 50 feet (15 m) or less in thickness, striking east for at least 1,200 feet (366 m), approximately 2 miles (3.2 km) south of Carpenter Lake*. For both these occurrences, further development was not recommended

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*Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie.

No.15 WATABEAG RIVER AREA

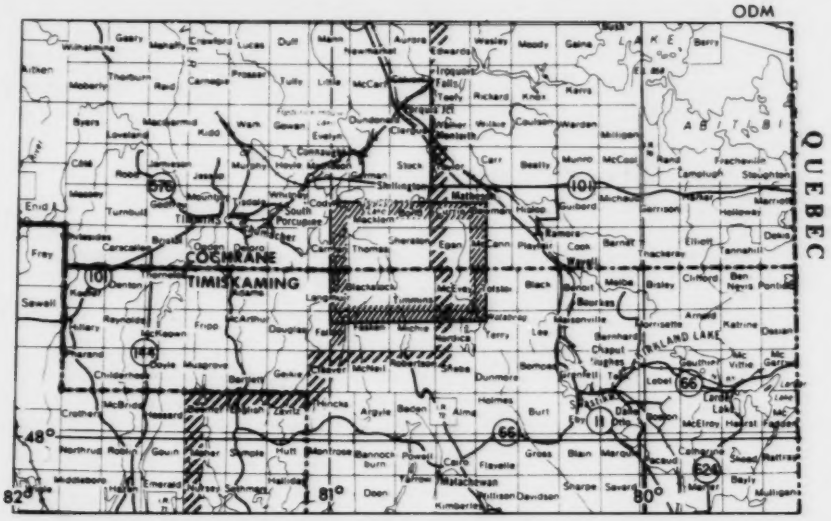
DISTRICTS OF COCHRANE

AND TIMISKAMING

by

D.R. Pyke[1]

LOCATION: The Watabeag River Area covers about 400 square miles (1036 km^2), and is bounded by Longitudes 80°30' to 81°00'W and Latitudes 48°15' to 48°30'N. The western boundary of the area is about 15 miles (24 km) east of the main town centre of Timmins.



LOCATION MAP Scale: 1 inch to 25 miles

Accessibility: Access to most of the area is good. Numerous township and concession roads extend south from Highway 101 into the northern part of the area. An all-weather gravel road traverses much of the eastern part of the area, and extends south from Matheson to intersect Highway 66 about 8 miles (13 km) east of Matachewan. A branch in the road near Watabeag Lake extends eastward across the southern part of the map-area to the Gibson Lake road, which, in turn, extends northwest to intersect Highway 101 3 miles (5 km) east of Night Hawk Lake.

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MINERAL EXPLORATION: Gold was discovered on the north peninsula of Night Hawk Lake in 1907, subsequently leading to the incorporation of Porcupine Peninsular Gold Mines Limited in 1921. Production from the mine was almost totally confined to the 1920s, when approximately 100,000 tons (Leahy 1971) of ore were milled, yielding about 25,000 ounces of gold (Byers 1948). To date, this has been the only producing gold mine in the area.

Extensive exploration work has been conducted in Langmuir and Carman Townships in the southwest part of the area. Interest in the area was prompted by the discovery of a small nickel deposit in southern Langmuir Township by McWatters Gold Mines Limited in 1964. Subsequently a joint venture by Noranda Mines Limited and Canadian Nickel Company Limited lead to the discovery of a nickel ore body in north-central Langmuir Township along the western boundary of the map-area. Production began in 1973, and ore reserves are estimated at 1.4 million tons averaging 1.87 percent nickel (Panorama 1973).

Only minor exploration work has been undertaken elsewhere in the area, and almost all of this has been confined to the northern part of the area in Macklem, Bond, Sheraton, Currie and Bowman Townships. Prior to the 1960s, most of the exploration work consisted largely of trenching in search of gold mineralization. The former property of Blanchette-Porcupine Gold Mines Limited near the southern part of Sheraton Township is one of the better known occurrences (Wright 1922, Berry 1940). Here, a number of grab samples of mineralized quartz veins taken during the 1930s, reportedly assayed greater than 1.5 ounces of gold per ton (Regional Geologist's Office Files, Ontario Ministry of Natural Resources, Timmins). Although the showing was drilled in 1937, no information is available on the results of this work (Berry 1940).

More recently a few geophysical surveys have been undertaken in the northern part of the area. Minor, follow-up diamond drilling has revealed no significant mineralization.

GENERAL GEOLOGY: Early Precambrian (Archean) metavolcanic and plutonic rocks underlie most of the area. Extensive outwash deposits of sand and gravel mantle most of the southeastern part of the area; lacustrine deposits of clay and silt cover much of the bedrock in the western part of the area.

The oldest rocks in the area are primarily composed of a sequence of high-magnesium basalts, best exposed in the northwest part of the area in the vicinity of Night Hawk Lake. These basalts are interpreted to be in the lower part of the Kenojevis Group (see Jensen 1974). The high-magnesium basalts extend southeast from the Night Hawk Lake area through part of Timmins and Michie Townships. An overlying sequence, composed dominantly of high-iron basalts, lies within the upper part of the Kenojevis Group and are best exposed in Bowman, Currie and southern Sheraton Townships. Further west, toward Night Hawk Lake there is a facies change in the upper Kenojevis Group, from a predominantly flow to a pyroclastic sequence. A more complete section of the upper part of the Kenojevis Group is present in the Ramore area to the east (see Jensen 1974).

A stock of medium- to coarse-grained hornblende syenite underlies much of Egan Township; the western margin of a similar stock extends into the eastern part of the area in McCann Township. The syenites display a variety of phases, the most common having a colour index of 3 to 5 percent, and an average grain size of 2 to 5 cm.

Large stocks of poorly exposed granodiorite underlie extensive portions of the area. Coarse-grained, porphyritic hornblende granodiorite is the most common phase, as found in Blackstock, Fallon and Tolstoi Townships. Leucocratic quartz-rich hornblende granodiorite forms the major portion of a stock underlying the western part of McEvay Township and adjacent Timmins Township. A similar granodiorite underlies parts of Egan and McCann Townships, and intrudes the syenitic stocks.

Early Precambrian, north-trending diabase dikes are ubiquitous, and form part of the northward extension of the dike swarm in the Matachewan area (Lovell 1967). Minor, northeast-trending, Middle and Late Precambrian diabase dikes traverse the northern part of the area.

Structural Geology: Top determinations from pillowed sequences, in conjunction with the morphology of the basaltic flows, indicates that the axial trace of an east plunging syncline extends from Night Hawk Lake to the west boundary of Egan Township. This is probably the westward extension of a major synclinal structure present in the Ramore area (see Jensen 1974). A complimentary anticlinal structure is interpreted to extend across the southeast part of the area; in part, the trace of the anticlinal axis appears to extend across McEvay Township, whereby the underlying granodiorite occupies a domal structure.

Numerous regional north- and northwest-trending faults traverse the area.

ECONOMIC GEOLOGY:

Gold: Numerous low assays of gold, in addition to a few spectacular values have been reported from many of the quartz veins in the northern part of the area. To date, only one deposit has proven to be economic.

The geology of the former Porcupine Peninsular mine is described by Byers (1940; 1948). Five ore zones were outlined; one is confined largely to a quartz vein, the others form part of carbonatized shear and brecciation zones cut by numerous quartz veins. The wall rock includes both basalt and a stock-like mass of albite syenite (Byers 1948) now largely carbonatized.

An interesting spatial association with ultramafic metavolcanics is evident in many gold deposits in the Timmins-Kirkland Lake Area. The gold deposits may be underlain by ultramafic metavolcanics or in some cases, ultramafic metavolcanics occur within and are intimately related to the

ore zones (e.g. the Preston mine in Timmins and the Kerr-Addison mine near Kirkland Lake). Much of the carbonate rock exposed in Northeast Bay of Night Hawk Lake consists of carbonatized ultramafic flows. These flows stratigraphically underlie the gold deposits at the north end of the Lake. It has been recognized by Shcherbakov and Perezhogin (1964) that the gold content of ultramafic rocks is greater than that of mafic and felsic rocks, and that there is a tendency (Viljoen et al. 1969) for the gold content to be greater in the extrusive variety than the intrusive variety of a specific rock type (i.e. basalt contains more gold than gabbro). This raises the possibility that the ultramafic metavolcanics may have provided the source for much of the gold at the north end of Night Hawk Lake, which was later mobilized (perhaps during carbonatization of the volcanics) and deposited in structurally favourable sites. Certainly many of the quartz stockworks could be considered a by-product of serpentinization and carbonatization of the adjacent ultramafic flows. A mechanism of this sort has been suggested for some of the gold deposits of the Barberton area in South Africa by Viljoen et al. (1969).

Nickel: The Langmuir nickel mine of Noranda Mines Limited and Canadian Nickel Company Limited was brought into production in 1973. The ore zone averages about 20 feet (6 m) thick and occurs at the base of a medium-grained serpentinized peridotite about 200 feet (60 m) thick. Massive sulphides tend to occupy depressions at the base of the serpentinite and are overlain by a halo of disseminated sulphide. Footwall rocks consist of massive basalt or fine-grained peridotite. Ore minerals consist of both pentlandite and millerite, the latter being most abundant at the north end of the ore-body where the footwall rocks are ultramafic rather than basaltic (Pyke 1974).

Ultramafic metavolcanics outcrop along the west shore of Carman Bay and form part of a distinctive stratigraphic level recognized in the Timmins and Peterlong Lake areas (Pyke 1973; 1974). It is near the base of the ultramafic flows in which economic concentrations of nickel are known to occur.

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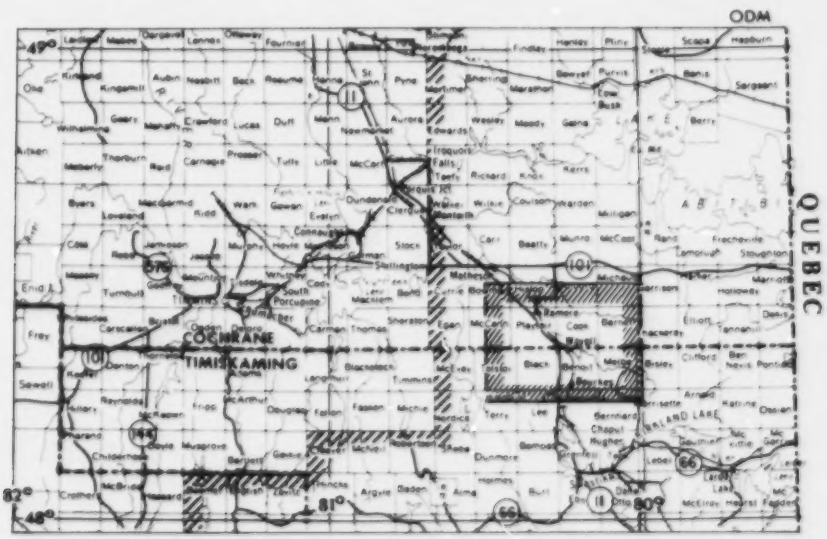
No.16 RAMORE AREA

DISTRICTS OF TIMISKAMING AND COCHRANE

by

L.S. Jensen[1]

INTRODUCTION: In 1974, a two year project consisting of geological compilation and mapping was initiated in the Ramore area. The Ramore map-area adjoins the Magusi River map-area to the east (Jensen 1972) and the Watabeag map-area



LOCATION MAP Scale: 1 inch to 25 miles

to the west (see Pyke 1974) and when completed will be part of a series of contiguous geological maps to be published at a scale of 1 inch to 1 mile of the Timmins-Kirkland Lake area.

LOCATION: The Ramore area is bounded by Latitudes 48°15' and 48°30'N and by Longitudes 80°00' and 80°30'W and covers about 400 square miles (1000 km^2). The area encompasses Barnet, Cook, Playfair, Black, Benoit and Melba Townships

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

and parts of Bowman, Hislop, Guibord, Michaud, McCann, Tolstoi, Terry, Lee, Maisonville and Bernhardt Townships, and includes, within its boundaries, the hamlet of Ramore and the Settlements of Wavell and Bourkes, all located along the Ontario Northland Railway right-of-way. The gold-mining community of Holtyre is also within its boundaries.

Access to the west half of the area is mainly by concession and logging roads that extend west and east from Highway 11. The southeast part of the area is accessible by road from Kirkland Lake via the Goodfish road and the northeast part of the area is partly accessible by logging roads that extend south from Highway 101, 3 miles (5 km) north of the area. East-central parts of the area are best reached by helicopter.

MINERAL EXPLORATION: Mineral exploration started with the discovery of gold in Playfair Township in 1905 (Wright 1922). Documentation of this early mineral exploration can be found in reports by Wright (1921; 1922) and by Moore (1936). More recent information on mineral exploration is found in reports on Michaud Township by Satterly (1948), on Guibord and Hislop Townships by Prest (1951; 1956 respectively), on Bowman Township by Leahy (1965), on Tolstoi, Black, Benoit, Terry, Lee and Maisonville Townships by Lovell (1971) and on Melba Township by Jensen (1972).

Gold has been the main target of mineral exploration in the area. This work has resulted in one past producer, Davidor Mines Limited in Benoit Township with a total production of 277 ounces Au and 50 ounces Ag (Lovell 1971); one producing mine, the Ross mine (Hollinger Mines Limited) in Hislop Township with production to 1972 of 699,575 ounces Au and 1,246,353 ounces Ag (Statistical Files of the Ontario Division of Mines); and one mine to be brought into production in 1975, the New Kelore Mines Limited property leased to Hollinger Mines Limited (Northern Miner 1974b). At present, several previously documented gold properties are also receiving attention, among them being the Golden Arrow property (Canadian Arrow Mines Limited) (Northern Miner 1974a) and the Gunnar Gold Mines property (Barymin Explorations Limited) (W. Dix[1], personal communication) both of which occur in Hislop Township.

GENERAL GEOLOGY: Bedrock consists of Early Precambrian sedimentary and volcanic rocks, generally of low metamorphic grade (prehnite-pumpellyite-quartz facies), Middle Precambrian (Huronian) sedimentary rocks and one northeast-trending diabase dike that is considered to be of Lake Precambrian (Keeweenawan) age. In addition, kimberlite dikes of unknown age cut the Early Precambrian rocks in Michaud Township. Pleistocene deposits of till, esker deltaic sand, beach sand, and varved clay overlie the bedrock throughout the area.

The Destor-Porcupine Fault trends east through the north part of the map-area in Michaud, Guibord and Hislop Townships. Steeply dipping Early Precambrian metasediments and metavolcanics face north, north of the fault, and face south, south of the fault. North of the fault in Hislop Township, the

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[1]Geologist, Barymin Explorations Limited.

Early Precambrian rocks appear to be mainly metasediments intercalated with a few metavolcanic flows of ultramafic and mafic composition. To the east in Guibord Township these grade laterally into predominantly metavolcanic flows of ultramafic and mafic composition with a few intercalated metasediments. Metasediments occur south of the Destor-Porcupine Fault stratigraphically below the metavolcanics which have intercalated sedimentary units to indicate a gradual facies change between the sedimentary rocks and the volcanic rocks to the south.

The metasediments are turbidites in the form of greywacke, argillite and chert; they are composed of volcanic material presumably derived from a nearby volcanic terrain to the southeast.

The metavolcanics which overlie the metasediments and intercalated ultramafic flows are thought to belong to the Kenojevis Group (Latulippe 1966) which, in Quebec, has been correlated westward to the Ontario-Quebec boundary by Dimroth[1] (personal communication). The Kenojevis Group in Ontario[2] comprises the group of predominantly tholeiitic volcanic rocks that directly underlie the calc-alkaline volcanic rocks of the Blake River Group (Roscoe 1965) to the south; the base of the Kenojevis Group lies to the north under Lake Abitibi where ultramafic flows and olivine basalt overlie an earlier phase of rhyolite volcanism (Eakins 1972; Jensen 1973).

South of the Destor-Porcupine fault, the Kenojevis Group is approximately 40,000 feet (12,000 m) thick consisting of alternating groups of flows composed of grey, low-iron (less than 10 percent FeO total) basalt, and black to dark green (more than 10 percent FeO total) basalt. A few ultramafic flows with high magnesium content occur in the flows toward the base of the sequence. Toward the top of the sequence, a strong differentiation trend toward high iron is indicated by basalts containing more than 16 percent FeO total. In Barnet Township some of these flows are capped by spherulitic black to light grey rhyolite (more than 70 percent SiO_2).

In the north parts of Melba and Benoit Township the tholeiitic volcanic rocks (Kenojevis Group) are conformably overlain by predominantly calc-alkaline volcanic rocks which are believed to be part of the Blake River Group (Roscoe 1965). They consist of low-iron, tholeiitic basalt flows interlayered with calc-alkaline basalt and andesite flows and fragmental rocks. These rocks become more felsic east of the map-area (Jensen 1972). The calc-alkaline volcanic sequence is concentrically folded in Benoit Township, into a syncline, (Lovell 1971), which occupies the approximate centre of an easterly plunging synclinorium (Jensen 1972). To the east, the calc-alkaline volcanic sequence is more complexly folded in Melba Township (Jensen 1972). Approximate thickness of the calc-alkaline volcanic rocks is 10,000 to 15,000 feet (approximately 3000 to 5000 m) in the map-area with the thickness increasing eastward.

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[1]Geologist, Ministère des Richesses Naturelles, Quebec.

[2]The stratigraphy of the Kenojevis Group in Ontario will be defined in the forthcoming Geological Report of the map-area.

South of the syncline in Benoit Township the calc-alkaline volcanic rocks are underlain by tholeiitic basalts with both high and low iron contents. In Balck Township the calc-alkaline volcanic rocks are enclosed to the west by tholeiitic basalt which is believed, by the author, to be part of the Kenojevis Group.

In McCann Township where the volcanic rocks have been strongly altered by the intrusion of the Wildgoose Lake syenite stock and the Watabeag Lake batholith, the tholeiitic volcanic rock sequence splits into two parts. The lower part of the sequence is folded northwest through Bowman Township toward Timmins (see Pyke 1974) and the upper part of the sequence is folded south around the nose of the syncline in Balck Township.

Timiskaming-type sedimentary volcanic and associated rocks occur in Hislop, Playfair, Guibord and Cook Townships. They consist of conglomerates, greywackes, and argillites of turbidite origin, interlayered with trachytic volcanic rocks. Apart from those found by the author in Cook Township, these Timiskaming-type rocks have been previously described by Prest (1956). A section of Timiskaming-type rock, some 6,000 feet (approximately 2000 m) thick, is exposed in Cook Township. Studies on these rocks are still incomplete but they have been tentatively divided into 13 rock-units which consist of conglomerate, arkose, argillite, trachyte, leucitite, and high-Fe basalt. Their relationship with the nearby tholeiitic volcanic rocks is not known.

Intrusive rock that range in composition from ultramafic to felsic cut the Early Precambrian rocks. Along the Destor-Porcupine Fault and in Black and Benoit Townships the volcanic rocks are cut by small stocks of peridotite and gabbro. Diorite cuts the calc-alkaline volcanic rocks in Benoit and Melba Townships but is rare elsewhere. The main intrusive rocks are syenite, monzonite, and feldspar porphyry in the form of stocks and dikes that cut the tholeiitic volcanic rocks in numerous places both north and south of the Destor-Porcupine Fault. The stocks range from less than 1,000 feet (305 m) across to more than 2 miles (3.2 km) across, the largest being the Wildgoose Lake syenite stock. Intense alteration zones occur around these intrusions. In the west part of the map-area the volcanic rocks are cut by the Watabeag Lake batholith which is composed of granodiorite. Matachewan diabase dikes cut all the Early Precambrian rocks throughout the map-area.

The Middle Precambrian rocks have been previously described by Lovell (1971). They consist of boulder conglomerate, greywacke and arkose with minor argillite and represent the Gowganda Formation of the Cobalt Group. They are flat lying and unconformably overlie the Early Precambrian rocks in the southwest part of the map-area.

ECONOMIC GEOLOGY:

Gold and Silver: Although gold and silver mineralization has been reported in several localities within the map-area, the most favourable locations of mineralization appear to be near and within zones of ultramafic volcanic

rocks high in Mg, previously described as talc-chlorite schists and carbonate rocks (Prest 1951; 1956; Satterly 1948). In 1974, the Ross mine at Holtyre in Hislop Township, operated by Hollinger Mines Limited, continued to produce gold and silver. Production form the mine in 1973 was 19,133 ounces Au and 15,962 ounces Ag. The mineralization, as previously described by Prest (1956), occurs in strongly altered and brecciated rocks believed to be of volcanic origin. Serpentine as well as talc is common in the surrounding rocks as evidenced by drill hole data (Lovell and Frey 1973) and by description of surface outcrops (Moore 1936).

More direct evidence that gold is associated with ultramafic volcanic flows occurs on the New Kelore Mines Limited property (leased by Hollinger Mines Limited) which is scheduled for production in late 1974. Here, carbonatized volcanic rocks with the polysuture fracturing typical of ultramafic lave flows, cut by syenite dikes, occur near the shaft. The gold mineralization is concentrated along the syenite contacts (Prest 1956).

Gold has also been reported to the east along the Destor-Porcupine fault in green carbonate rock in Guibord and Michaud Townships (Satterly 1948; Prest 1951). Ultramafic flows occur near these carbonates and are cut by granitic rock.

A similar phenomenon occurs in Gauthier, McVittie and McGarry Townships in the Kirkland Lake-Larder Lake area. Here, many of the carbonate rocks described by Thomson (1941) and Thomson and Griffis (1941) can be shown to be ultramafic flows on the basis of relict structures and textures (e.g. polysuturing, spinifex). One of the best examples of gold associated with these ultramafic flows occurs in the vicinity of the Kerr Addison mine in McGarry Township. Here pillow structures were recognized by Thomson (1941) in the "carbonatized volcanic rocks" which form part of the above mentioned carbonatized ultramafic flows. Similar features occur in the Timmins area (Pyke 1974) and in the Barberton Mountain Area, South Africa (Viljoen et al. 1969).

South of the Destor-Porcupine fault in Hislop, Playfair and Barnet Townships, gold occurs near, and within many of the syenite and syenite porphyry intrusions. For example, on the Golden Arrow Mines Limited property, described by Prest (1956), gold occurs in quartz veins north of the main syenitic intrusion which cuts strongly fractured and hematized volcanic rocks.

In Black and Benoit Townships, where major syenite intrusions or major fault systems are absent, gold is mainly associated with quartz veins and quartz-carbonate veins. Most of these occurrences have been previously documented by Lovell (1971).

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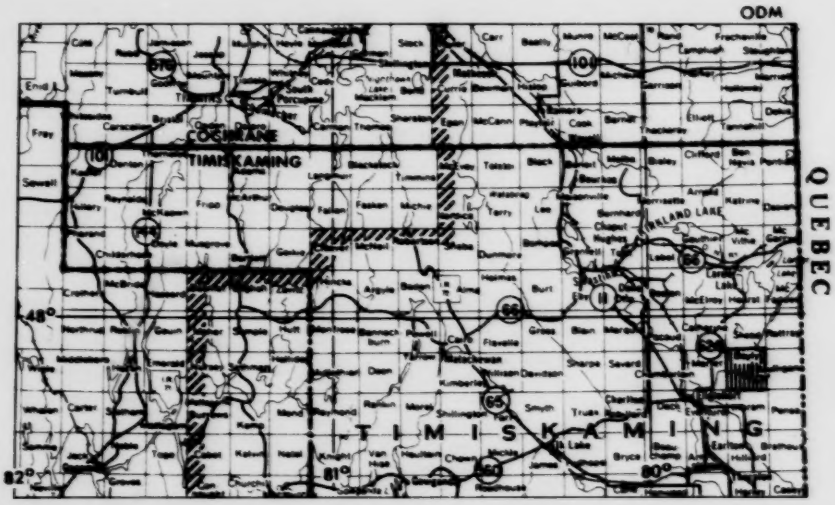
No.17 BAYLY TOWNSHIP

DISTRICT OF TIMISKAMING

by

H.L. Lovell[1]

LOCATION: The map-area is 6 miles (9.6 km) northeast of Englehart, for which it constitutes the main cottage area, and 10 miles (16 km) south of Larder Lake. Road access to the western part of the Township is from the Englehart-



LOCATION MAP Scale: 1 inch to 25 miles

to-Larder Lake Highway 624, and to the southern part is by farmland roads along concessions and lot lines from Englehart to Wendigo, Crystal, Skelton-pup, and Skeleton Lakes. The eastern part of Bayly Township is accessible by boat from the lakes along the Larder River.

MINERAL EXPLORATION: Along and west of the Larder River The Hudson Bay Mines Limited did magnetometer, electromagnetometer, and geological work in 1972 and Bute Larder Gold Mining Syndicate Limited did some rock trenching and assaying in 1938. Files for both these are in the Resident Geologist's office, Ontario Ministry of Natural Resources, Kirkland Lake.

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[1]Resident Geologist, Ontario Ministry of Natural Resources, Kirkland Lake.

Rockwork was done in the early days on heavy pyrite mineralization west of the narrows between Wendigo Lake's upper and lower parts.

GENERAL GEOLOGY: West and north of the Larder River-Wendigo Lake waterway are Early Precambrian (Archean) metavolcanic rocks mainly mafic to intermediate in composition, but with minor amounts of serpentine-bearing ultramafic rock.

East and south of the Larder River-Wendigo Lake waterway the exposed bedrock consists of cliffs and mesas of Middle Precambrian (Proterozoic) sedimentary and intrusive rocks. The sedimentary rocks are conglomerate, arkose, and argillite of the Gowganda Formation of the Cobalt Group. Almost all the intrusive rocks are gabbroic to dioritic in composition, and probably all are phases of Nipissing Diabase.

The soil consists of lodgement and ablation till; sand and gravel, particularly in the esker along the east shore of the Larder River and the part of Wendigo Lake upstream from the narrows; and varved clay deposits of glacial Lake Barlow-Ojibway. Recent deposits of muskeg, dune sand, and stream gravel bars also are present.

Structural Geology: The southwest-trending course of the Larder River and the upper part of Wendigo Lake follow a lineament that probably represents a major northeast-trending fault. At the same topographic elevation, the bedrock southeast of this fault consists of thick gently dipping Gowganda sedimentary rocks, whereas northwest of the fault the bedrock consists of steeply dipping Early Precambrian (Archean) metavolcanics. On the west bank of the waterway, the dips of the Gowganda sedimentary rocks are less than the maximum angle of repose of sediments, mostly being about 20SE. The contact between the Gowganda Formation and the underlying Early Precambrian metavolcanics dips much more steeply however, averaging about 50SE. It seems probable, therefore, a fault (presumably) escarpment existed prior to the Gowganda Formation sedimentation. At that time apparently the southeastern side of the proposed Larder River Fault was already downdropped.

The long axis of the trellis drainage pattern east and north of the Larder River-Wendigo Lake waterway is developed parallel to the strike of the Early Precambrian (Archean) strata, and probably follows units sheared during folding of the strata into near-vertical attitudes.

ECONOMIC GEOLOGY: Prospectors spreading out from the silver discoveries at Cobalt in 1903 worked their way up the Larder River through Bayly Township before 1906. The prospectors were following the two main rock types associated with the silver discoveries, i.e., Cobalt Group sedimentary rocks and Nipissing Diabase, which form the banks of the Larder River-Wendigo Lake waterway along most of its length. Although in 1906 the prospectors came upon gold north of Bayly Township by the shore of Larder Lake (Thomson 1941), little or no Cobalt-

type silver mineralization was discovered. However, the writer was shown a water-worn nugget of silver which was reported to have been found in the area. Apparently, the nugget had been glacially transported to a deposition site in an esker, and was possibly further reworked by Recent stream action.

An Early Precambrian felsic metavolcanic sequence of cherty tuffs and rhyodacite strikes approximately south from Skead Township up to the contact with the Middle Precambrian covering rocks in Bayly Township. The Middle Precambrian rocks east of the Larder River are on the downdropped side of the proposed Larder River Fault: therefore, any Early Precambrian felsic metavolcanics which may exist beneath the Middle Precambrian rocks on the east side of the fault may be beyond the limits of detection by electromagnetic exploration methods in common useage.

Sand and gravel is present, particularly in the esker that extends along the east shore of the part of Wendigo Lake north of the narrows and south of the western end of Skeleton Lake.

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1941: Geology of McGarry and McVittie Townships, Larder Lake Area; Ontario Dept. Mines, Vol.50, Pt.7, 99p. (published 1943). Accompanied by Maps No. 50a and 50b, scale 1 inch to 1,000 feet, and Map 50d, scale 1 inch to 400 feet.

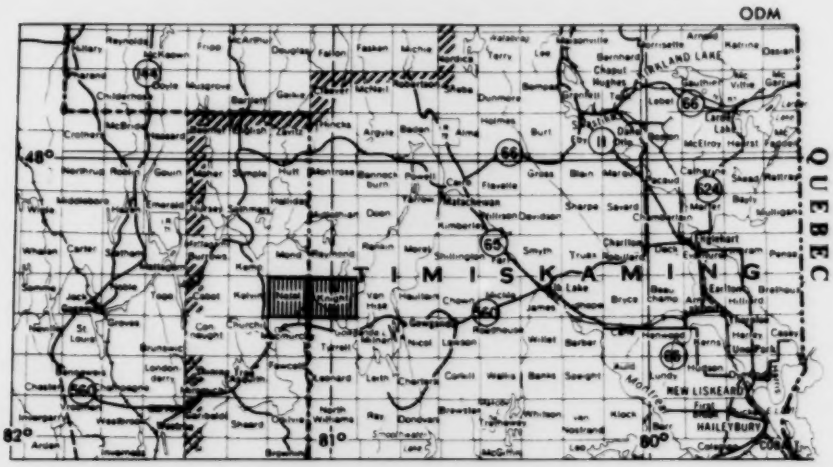
No.18 NATAL AND KNIGHT TOWNSHIPS

DISTRICTS OF SUDBURY AND TIMISKAMING

by

M.W. Carter[1]

LOCATION: Natal and Knight Townships straddle the boundary of the Districts of Sudbury and Timiskaming between Latitudes 47°40' and 47°45'30"N, and Longitudes 80°55' and 81°12'W. Access is moderately good for Knight Township but poor for Natal Township. Knight Township can be reached by water by entering the West Montreal River system at the intersection of the latter and Highway 560 in north Tyrrell Township to the south. By road, the southwestern part of Knight Township and the eastern part of Natal Township can be reached by following the Ontario Hydro road northwards from its intersection with Highway 560 in northwestern Tyrrell Township. The rest of Natal Township can best be reached by float aircraft.



LOCATION MAP Scale: 1 inch to 25 miles

Both Townships were mapped at a scale of 1 inch to ¼ mile during the summer of 1974.

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MINERAL EXPLORATION: Recorded prospecting activity in the map-area began in 1930 in Knight Township and in 1945 in Natal Township. It continued up to 1971 with a four-year break from 1940-43. Exploration activity was carried out primarily for gold and copper in the early years, but later, nickel was actively sought. Knight Township was explored for gold and nickel, and Natal Township for copper and gold.

Knight Township: In 1930 the first recorded exploration* was by McIntyre Porcupine Mines Limited who trenched a metavolcanic-granodiorite contact on their nine-claim property in the southwestern part of the Township. Part of the property was later trenched by a Mr. Duggan in 1937, and diamond drilled in 1938, when 13 holes totalling 1,955 feet (596 m) were put down.

In 1931 the L.O. Hedlund property, a mile to the east of the McIntyre Porcupine Mines Limited property, was staked and optioned to J.C. Waite and later to M.J. O'Brien. Extensive trenching and diamond drilling were carried out on the property which extends into Tyrrell Township to the south. In 1936 it was taken over by Tyranite Mines, Limited who sank a three-compartment shaft in Tyrrell Township where all major development was carried out*.

In 1931, L.F. Hurst discovered gold, molybdenite, pyrite and chalcopyrite near the south end of Pigeon Lake. In 1936 the property was mapped by Erie Canadian Mines Limited*.

In 1933 D.H. Gardner discovered gold in the area east of Arthur Lake, southwest Knight Township. The showings were later examined by Erie Canadian Mines Limited in 1936, and by Hollinger Gold Mines Limited in 1939. Work was resumed in 1959 when Courageous Gold Mines Limited diamond drilled 17 short holes for a combined length of 1,338 feet (408 m). Further diamond drilling, amounting to 1,081 feet (329 m) from five holes was carried out by New Senator Rouyn Limited in October of 1964. The discovery of nickel on the property by A. Decker in 1965 led to further diamond drilling by W.D. Sutherland and Associates in 1966 who diamond drilled 6,396 feet (1950 m) in nine holes on the property, and by the new owners, Arthur Lake Mines Limited in 1967 who diamond drilled an additional 5,626 feet (1715 m) in 12 holes. Following this, Timiskaming Nickel Limited engaged Huntec Limited and Lockwood Survey Corporation Limited in 1968 to carry out airborne magnetic and electromagnetic surveys over the west half of the Township which included the property. No major anomalies were located, but Timiskaming Nickel Limited diamond drilled 14 holes totalling 5,477 feet (1669 m) in the area in the spring of 1968*.

In 1935-37 Erie Canadian Mines Limited carried out trenching and a detailed examination of properties located in the vicinity of Brush Lake in the southwest of the Township. Thirty years later, in 1967, Timiskaming Nickel diamond drilled two holes on the shore of the lake for a total footage of 737 feet (225 m)*.

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*Information from: Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

In 1939 L.L. Coulis carried out trenching and pitting on his property on the shore of Duncan Lake near the northern boundary of Knight Township with Raymond Township.

In the same year, 1939, Hollinger Gold Mines Limited extensively trenched three claims held by A. Decker in the southwestern corner of the Township. Later, in the period 1944-45, Camdeck Gold Mines Limited diamond drilled 22 holes for a total length of 2,051 feet (625 m) on the property. This was followed by the diamond drilling of nine holes totalling 2,505 feet (764 m) by Becnite Mines Limited in 1950. Then, eight years later in 1958, Wexford Mines Limited diamond drilled five holes totalling 500 feet in the same area and this was followed by an additional six holes totalling 2,646 feet (807 m) in 1965, by Initiative Explorations Limited*.

In 1965 Whitegate Mining Company Limited diamond drilled two holes totalling 1,253 feet (382 m), and in 1967 two further holes totalling 1,037 feet (316 m) on their property at Pigeon Lake*.

In 1968 Wahbic Explorations Limited diamond drilled three holes totalling 1,632 feet (497 m) on their property in central Knight Township*.

Finally, in 1971 Amax Potash Limited carried out a vertical electromagnetic survey on a property near Pigeon Lake, outlining a 4,000 foot (1200 m) conductive zone. Ground magnetometer work revealed two areas inferred to be underlain by mafic and ultramafic intrusive bodies. Geological and geochemical surveys were subsequently conducted in 1972 to check the inference*. No further work was recorded.

Natal Township: The earliest recorded activity was by A. Fuller in 1945 in the southeast corner of the Township where Fuller diamond drilled 12 holes amounting to 1,421 feet (433 m) in breccias and trachyte flows*.

In 1948 McIntyre Porcupine Mines Limited carried out blasting, trenching and geological mapping on its property and others in the northeastern part of the Township, where a number of quartz veins in conglomerate and arkose were examined.

Later, in 1956, Lucky Creek Mining Company Limited sank two pits on a brecciated quartz vein in greywacke on their claim group in central Natal Township.

In 1967, Timiskaming Nickel Limited drilled eight diamond drill holes in the northeast corner of the Township with a combined length of 3,602 feet (1098 m) through Cobalt sediments and Early Precambrian metavolcanics*.

Finally, in 1967 D.W. Sullivan carried out a magnetometer and electromagnetic survey on a group of claims owned by Talisman Mines Limited on the west central boundary of Natal Township. Several weak anomalies were located*.

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*Information from: Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

GENERAL GEOLOGY: Geological investigations began in the area in 1896 when Burwash (1896) examined the country along the Nipissing-Algoma Line which divides Natal and Knight Townships. Then in 1925 Finley (Gledhill 1926) mapped Natal Township at a reconnaissance scale of 1 inch to 1½ miles as part of a larger area comprising the Townships of Burrows, Kemp, Mond, Cabot, Kelvin and Natal. In 1931 Graham (1932) mapped Knight Township and the eastern part of Natal Township at a scale of 1 inch to 3/4 mile. In 1973, L.G. Closs and E.V. Sado (1973) carried out a combined reconnaissance exploration geochemistry-Quaternary geological survey in Natal Township as part of a larger survey of Halliday, Midlothian, Kelvin, Natal, Churchill and Macmurchy Townships.

The map-area is underlain by Early and Middle Precambrian rocks which are covered by a mantle of Pleistocene and Recent deposits.

The Early Precambrian rocks are exposed in northeast and southwest Knight Township and throughout Natal Township. They comprise a mafic to felsic metavolcanic sequence, ultramafic rocks, intrusive felsic to intermediate plutonic rocks, and diabase dikes. Chemically, the metavolcanics comprise a suite of subalkalic rocks and a suite of alkalic rocks. The former consist of basalts, andesites, dacites, and rarely rhyodacites and rhyolites, extruded both as flows and pyroclastics. The mafic and intermediate flows were extruded subaqueously as they show pillowed structures. The pyroclastic rocks, best developed in central and western Natal Township, were deposited subaqueously, are intermediate in composition, and show well-developed sedimentary structures in association with chert horizons. The alkalic rocks comprise trachybasalt, trachyandesite and trachyte flows and pyroclastics which are mauve, dark red and light pink in colour. These alkalic metavolcanic rocks are best developed in southeast Natal Township. The ultramafic rocks are serpentinites showing 'spinifex' texture and pillow-like structures, and they are interlayered with the metavolcanics. Stratigraphically, the volcanic suite can be subdivided into a lower and upper part: the lower consisting mainly of subaqueous flows, and predominantly subalkalic in composition; the upper part consisting predominantly of subaqueous tuffs and predominantly subalkalic in composition. The ultramafic and alkalic rocks occur at the top of the lower part of the sequence. Felsic metavolcanics are rare and occur in the zone between the lower and upper parts of the sequence. The intrusive felsic to intermediate plutonic rocks are exposed in northeastern and southwestern Knight Township and comprise granite, granodiorite, syenite and diorite. These rocks are massive and medium- to coarse-grained. Dikes, ranging in width from 50 to 200 feet (15 to 60 m), and consisting of black, variably magnetic, fine- to medium-grained diabase, form a northwesterly trending swarm. They are best developed in Natal Township and were not observed cutting the Huronian sedimentary rocks.

Middle Precambrian, Huronian sedimentary rocks unconformably overlie the Early Precambrian rocks and are best exposed in central and eastern Knight Township and in northeast Natal Township. The Huronian sedimentary rocks are orthoconglomerate, paraconglomerate, arkosic sandstone, greywacke, silt-

stone and argillite of the Gowganda Formation of the Cobalt Group. These sedimentary rocks are intruded by Nipissing Diabase, which forms a well-defined sill within the Cobalt rocks. The sill strikes north, dips about 25 to 30 degrees east, and has an exposed width of about 2,000 feet (600 m).

Cenozoic deposits of sand, gravel, and alluvium are best developed in central Knight Township. An esker, about 6 miles (9.7 km) long traverses the eastern part of Knight Township. Swamp deposits cover large areas in central Knight Township.

Structural Geology: In Natal Township, the Early Precambrian metavolcanic-ultramafic assemblage is folded synclinally about a N50W-trending fold axis which plunges northwesterly; in Knight Township, where fold axes were not located, these rocks trend northwesterly.

The Huronian sedimentary rocks are folded about a northerly trending axis in northwestern Knight Township, but are homoclinal in the central and eastern part of the Township. Dips range from 15 to 35 degrees, but steepen in places to 75 degrees where they may be overturned.

Three major lineaments, regarded as faults, cross the map-area: one in east-central Knight Township, cutting Huronian rocks and trending northerly; and two parallel northwesterly lineaments, one in south-central Knight Township following the West Montreal River, the other crossing Natal Township diagonally from the northwest to the southeast.

ECONOMIC GEOLOGY:

Copper: Copper occurs as disseminated grains of chalcopyrite in quartz veins in the metavolcanics and Cobalt sedimentary rocks. The only area from which assay results are available is Seganku Lake in central Natal Township from the former property of McIntyre Porcupine Mines Limited, and adjacent showings. Samples taken from blastings and assayed for McIntyre Porcupine Mines Limited showed best assays as follows: on the McIntyre occurrence, 0.25 percent Cu over 10 inches (25.4 cm) from an east-striking quartz vein 8 to 25 feet (2.4 to 7.6 m) long and 4 to 12 inches (10.2 to 30.5 cm) wide, dipping from 80N to vertical in conglomerate and arkose*; on a neighbouring occurrence to the south, the Buffalo-Ankerite vein, 1.28 percent Cu over 3.0 feet (0.9 m) from a northeast-striking, vertically dipping quartz vein in quartzite*; and on another occurrence, the Teegema vein, 1.5 percent Cu over 2.7 feet (0.8 m) from an east-striking quartz vein 3 inches (7.6 cm) to 17 feet (5.2 m) wide and about 35 feet (10.7 m) long in greywacke, arkose and quartzite*.

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*Information from: Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

Gold: Gold occurs in quartz veins and stringers in shears in the metavolcanics and granitic rocks.

The best showing is on the original A. Decker property in the southwestern corner of Knight Township, staked in 1939. The gold occurs in shears accompanied by "quartz stringers and carbonated bands mineralized with fine and coarse pyrite*". Two main shear sets were extensively trenched and drilled. The 'East Shear' strikes approximately N20E and varies in width from 4 to 30 inches (10.2 to 76.2 cm). The host rocks are described as trachyte and carbonatized fragmental lava. A 3 foot (0.9 m) channel sample taken by Camdeck Gold Mines Limited from the main trench which cut a mineralized green carbonate-quartz zone returned $26.56 per ton in gold (gold at $38.00 per ounce)*. Assays from a diamond drill hole drilled by Camdeck Gold Mines Limited below this trench returned $23.49 per ton in gold over 4.5 feet (1.37 (1.37 m) (gold at $38.00 per ounce)*. Three hundred feet (100 m) north of the main trench, another diamond drill hole sunk by Camdeck Gold Mines Limited intersected a 7 foot (2.13 m) section of sheared trachyte which assayed $26.95 per ton in gold (gold at $38.00 per ounce)*. The 'West Shear' strikes about north through a wall rock of spherulitic lava containing a massive sulphide zone 4 inches (10 cm) wide at the surface. Assays obtained by Camdeck Gold Mines Limited of a grab sample from this zone and from a 4.2 foot (1.28 m) section of diamond drill core cutting it at depth, yielded $34.26 and $45.82 per ton in gold respectively (gold at $38.00 per ounce)*. Diamond drilling and resampling in 1950 by Becnite Mines Limited on the same veins gave assay results of $5.25 per ton in gold over 20 inches (50.8 cm) of core (gold at $38.00 per ounce)*, and $103.95 per ton in gold over 14 inches (35.6 cm) from a grab sample (Northern Miner 1950).

Another important property was the original property of D.H. Gardner staked in 1933 in southwestern Knight Township at Arthur Lake. Free gold was reported* in a carbonatized porphyry dike associated with quartz stringers and finely disseminated pyrite. The carbonatized zone is 22 feet (6.7 m) wide and strikes N20W with a dip of 70 degrees to the west. Except for specimens showing free gold, surface samples taken by Erie Canadian Mines Limited yielded low values*. However, a 42 inch (1.07 m) section of core from holes diamond drilled in 1959 by Courageous Gold Mines Limited assayed $16.80 per ton in gold (gold at $33.57 per ounce)*.

Nickel: Nickel occurs as pentlandite in sooty disseminations in 'deckerite', "a type of acid tuff breccia"* in an area underlain by serpentinite at Arthur Lake, in southwestern Knight Township.

The most important occurrence, which is at Arthur Lake where nickel was first discovered by A. Decker in 1965, was diamond drilled by W.D. Sutherland and Associates in 1966 and drill core assays returned up to 0.88 percent nickel over 4 feet (1.2 m), with minor amounts of gold, cobalt, silver and copper*. Further diamond drilling in the area by Arthur Lake Mines Limited in 1967 indicated a nickel content as high as 0.96 percent over a 5 foot (1.5 m) drill section*.

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*Information from: Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

Silver: Silver has been reported from a vein 2½ feet (0.8 m) wide located in the contact region of Nipissing Diabase and Cobalt sedimentary rocks from the former Coulis property on Duncan Lake in northern Knight Township. Assay of the material from the pit collected by the owner indicated 131 ounces of silver per ton as the best assay, associated with gold at 3.50 ounces per ton*. The type of sampling is not known.

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1973: Reconnaissance Exploration Geochemistry-Quaternary Geology Research Within Felsic Centres of the Abitibi Greenstone Belt, Districts of Sudbury and Timiskaming; p.168-171 in Summary of Field Work, 1973, by the Geological Branch, edited by V.G. Milne, D.F. Hewitt and W.J. Wolfe, Ontario Div. Mines, MP56, 202p.

Gledhill, T.L.
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Graham, A.R.
1932: Tyrrell-Knight Area; Ontario Dept. Mines, Vol.41, pt.2, p.25-61. Accompanied by Map 41b, scale 1 inch to 3/4 mile.

Northern Miner
1950: Diamond Drilling to Start at Becnite Property (article); The Northern Miner, July 20, 1950, p.2 (850).

*Information from: Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

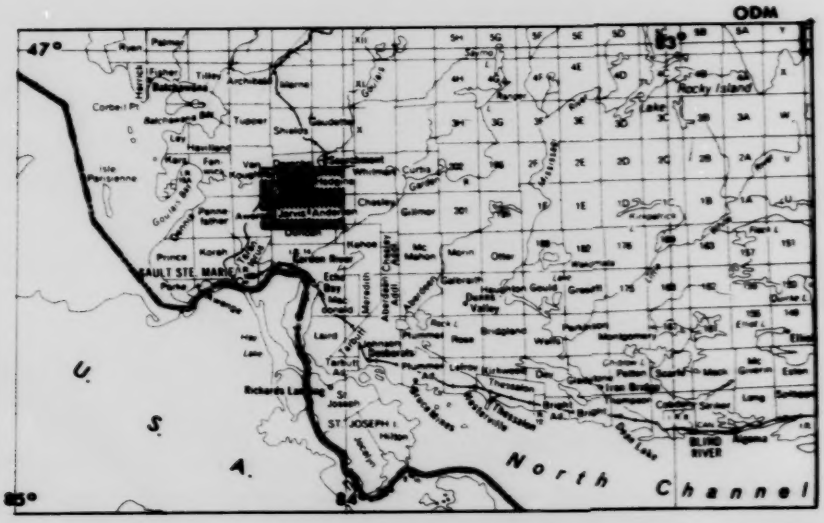
No.19 JARVIS LAKE-GARDEN RIVER AREA

DISTRICT OF ALGOMA

by

Gerald Bennett[1]

LOCATION AND ACCESS: The area mapped lies about 16 miles (26 km) northeast of the City of Sault Ste. Marie, and is bounded by 84°00'W to 84°15'W Longitude and 46°37'30"N to 46°45'N Latitude. This area includes all of Jarvis



LOCATION MAP Scale: 1 inch to 25 miles

Township as well as parts of Anderson, Hodgins, Aweres, Duncan, Deroche and VanKoughnet Townships, an area of approximately 100 square miles (260 km^2).

Highway 556 from Sault Ste. Marie passes through the northern part of the map-area. Recently constructed bush roads in Anderson and Jarvis Townships are accessible by a gravel-surfaced road extending northward from Highway 17 east of Sault Ste. Marie.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Sault Ste. Marie.

MINERAL EXPLORATION: In about 1870, prospectors discovered sulphide mineralization near the common boundary of Jarvis and Duncan Townships northeast of Sault Ste. Marie. Subsequent exploration and development of the Victoria galena mine led to the sinking of two shafts to 410 feet (125 m) with development on eight levels. A small but unknown tonnage of lead-silver ore was shipped between 1887 and 1916 (Burns 1956).

Between 1951 and 1957 the property was acquired and operated by Jardun Mines Limited. At the termination of operations in 1957, the total production had reached 145,029 tons of lead-zinc ore from three shafts and one adit (Field 1958, p.108-109). Jardun Mines Limited is now considered defunct (Canadian Mines Handbook 1961, p.121).

Several small vein-type deposits of base metal sulphides, principally galena and sphalerite, occur in association with calcite veins in the general vicinity of Maple Lake in Deroche Township. These occurrences appear to have been known for many years but most were re-examined by mining companies within the last 15 years. All of the claims have been allowed to lapse.

In 1950, The Jarvis Deep Syndicate carried out prospecting, trenching and a magnetometer survey over a galena occurrence about ¼ mile (0.4 km) north of the west end of Jarvis Lake. Subsequent diamond drilling of this occurrence was carried out by Base Metal Mines Limited in 1952, and by De Ville Copper Mines Limited in 1957 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). The claims have since been allowed to lapse.

Around the turn of the century prospecting centred around hematite-bearing quartz veins discovered in the vicinity of Northland Lake. Between 1900 and 1905 a small tonnage of specularite from one of these deposits was shipped by the Breitung Iron Mining Company from small open pits and adits on the west side of Northland Lake (McConnell 1926, p.47). However, the tonnage and grade of this deposit and the Williams deposit located about 4,000 feet (1220 m) southeast of Northland Lake, have so far proved to be too low to be significant by today's standards (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

There was no exploration activity in the map-area during the past field season.

GENERAL GEOLOGY: A northerly trending belt of Early Precambrian (Archean) metavolcanics with a maximum width of 2½ miles (4 km) extends from the southern boundary of the map-area in Duncan Township to southwestern Hodgins Township, a distance of 6 miles (10 km). Another area of mafic metavolcanics extends westward from Northland Creek in Deroche Township. The metavolcanic belts consist almost entirely of mafic to intermediate flows, with only minor occurrences of intermediate to felsic metavolcanics, clastic metasediments and iron formation. In Hodgins Township, the metavolcanics show a pronounced metamorphic layering as a result of the development of alternating 1 to 3 cm-thick layers containing variable proportions of epidote, amphibole and plagioclase. The degree of metamorphism of the Northland Creek belt appears to be less than that of the metavolcanics of Hodgins Township.

The Early Precambrian metavolcanics are intruded by a variety of felsic to intermediate plutonic rocks. Pale-pink to grey, foliated to gneissic quartz diorite, trondhjemite and quartz monzonite are largely restricted to the eastern parts of Anderson and Hodgins Townships. The gneissic granite is intruded by small bodies and dikes of massive to faintly foliated, subporphyritic diorite. The youngest recognized granitic pluton consists mainly of porphyritic and equigranular quartz monzonite and quartz syenite which underlies most of Jarvis Township. This body contains many partly digested mafic inclusions with associated hybrid dioritic rocks.

Numerous northwest-trending dikes of diabase and altered diabase intrude the Early Precambrian granitic and metavolcanics but do not intrude the Middle Precambrian assemblages.

In the southwestern part of the map-area the Early Precambrian rocks are unconformably overlain by Middle Precambrian clastic and volcanic assemblages termed the Soo Series by McConnell (1926). The stratigraphic relationship between the Soo Series and other Middle Precambrian assemblages of the Southern Province of Ontario has been a problem for some time. However, for purposes of this preliminary note, McConnell's original terminology will be retained.

The lowermost unit of the Middle Precambrian within the map-area, termed the Driving Creek Formation by McConnell (1926), consists of pale-coloured quartzite and minor polymictic paraconglomerate. This formation lies unconformably upon Early Precambrian granitic rocks between the south end of Reserve Lake and Highway 556.

The Driving Creek Formation is conformably overlain by the Duncan Greenstone, a thick assemblage of Middle Precambrian, massive and amygdaloidal basalt with minor agglomerate and breccia. A reliable estimate of the thickness of the volcanic rocks and the underlying quartzite is not available due to extensive faulting along the contacts; however, the Duncan Greenstone may be at least 5,000 feet (1500 m) thick within the map-area.

The Aweres Formation overlies the Duncan Greenstone, but is generally found to be in fault contact with it. The lowermost portion of the Aweres Formation exposed in the map-area consists mainly of about 3,000 feet (914 m) of polymictic paraconglomerate and orthoconglomerate containing abundant mafic volcanic debris with cobbles and boulders of granitic rocks, quartz, and quartzite in a sandstone matrix.

Conglomerates containing mafic volcanic clasts are interbedded with cross-bedded sandstones and well sorted granite and quartz pebble conglomerates for a thickness of about 3,000 feet (914 m) above the lower conglomerate assemblage. The uppermost exposed Aweres Formation of the map-area consists of cross-bedded quartzite to arkose with local conglomerate lenses.

Thick clastic accumulations of the Cobalt Group occupy a large, mostly fault-bounded, west-northwest trending trough extending from Northland Lake to the northwest corner of the map-area in VanKoughnet Township. The Cobalt Group rocks unconformably overlie the conglomerates of the Aweres Formation in the Bellevue area.

The Gowganda Formation of the Cobalt Group consists mainly of a basal unit of polymictic conglomerate overlain by thinly bedded siltstone and argillite, and locally arkose and pink quartzite.

The contact between the Gowganda Formation and the quartzites of the overlying Lorrain Formation is poorly exposed and may also be faulted at most localities.

The Middle Precambrian clastic rocks are intruded by several continuous dikes and one thick sill-like body of Nipissing-type diabase. Dikes of pink syenite or granophyre in the southwestern portion of the map-area may be of Nipissing age or younger.

A small body of Late Precambrian (Keweenawan) quartz-feldspar porphyry is located near the west end of Jarvis Lake. This is the youngest known igneous rock in the map-area.

Structure: The foliation of the metavolcanics in Anderson and Hodgins Townships suggests a homoclinal sequence dipping steeply to the east. A few pillow structures recognized in the metavolcanics of Deroche Township suggest that the Early Precambrian rocks of that area face northwards.

The present distribution and attitudes of the Middle Precambrian rocks is largely the result of extensive block faulting. Indirect evidence such as shearing and topographic lineaments suggest that most of these faults strike parallel or sub-parallel to the strike of the major formations. A right lateral fault between Reserve Lake and Trout Lake has a displacement of 2,000 feet (610 m).

ECONOMIC GEOLOGY: The production of the Victoria galena mine and Jardun Mines Limited was obtained from four major galena-sphalerite bodies which occur near or along a N15W striking fault zone between Sandy Lake and Weashkog Lake in southern Jarvis Township.

Burns (1956) stated that the main period of mineralization was characterized by the deposition of galena, sphalerite and magnetite with lesser amounts of specularite, pyrite, chalcopyrite, pyrrhotite, arsenopyrite, epidote, quartz, and calcite. These minerals formed veins and erratic disseminations within zones of intense chloritization up to 100 feet (30 m) wide within sheared granitic rocks and diabase.

Production figures from the files of the Mineral Resources Branch, Ontario Division of Mines, indicate that between 1954 and 1957, 145,029 tons of ore were milled with an average grade of 3.43 percent lead and 2.44 percent zinc. Some silver and gold were also recovered.

The Northern Miner of March 24, 1960, stated that at the time of shutdown in 1957 the reserves were estimated at 36,367 tons in two zones consisting of 20,000 tons containing 2.2 percent lead, 2.6 percent zinc, 1.73 ounces of silver per ton, and 16,367 tons averaging 6.6 percent lead, 3.6 percent zinc and 1.1 ounces of silver per ton.

The Jarvis Deep Syndicate prospect consists of narrow veins of galena, sphalerite and pyrite within a sheared diabase dike about ¼ mile north of the Jarvis Lake in Jarvis Township. The zone strikes N25W and dips 75W to vertical. Chip samples taken by The Jarvis Deep Syndicate indicated an average grade of 2.06 percent lead, 3.08 percent zinc and 0.70 ounce of silver per ton over 2.7 feet. Diamond drilling by De Ville Copper Mines Limited indicated a best assay of 4.1 percent lead, 4.75 percent zinc and 0.6 ounce of silver per ton over 2.3 feet (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

Several approximately north-striking shear zones containing quartz-carbonate veins occur within Early Precambrian (Archean) mafic metavolcanics about ½ mile (0.8 km) southeast of Maple Lake in Deroche Township. Many of these veins contain varying amounts of argentiferous galena and sphalerite. Specularite, pyrite and chalcopyrite are common associates. In 1951-52 Teck Exploration Company Limited tested several of these showings with a total of 19,485 feet (5,939 m) of diamond drilling in 49 holes. The best assays submitted with the drill logs are 7.60 percent lead, 1.86 percent zinc and 1.14 ounces of silver per ton over 3 feet and 11.8 percent lead, 9.3 percent zinc and 1.48 ounces of silver per ton over 1 foot. Most assays indicated less than 1 percent combined lead and zinc with a correspondingly lower silver content (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

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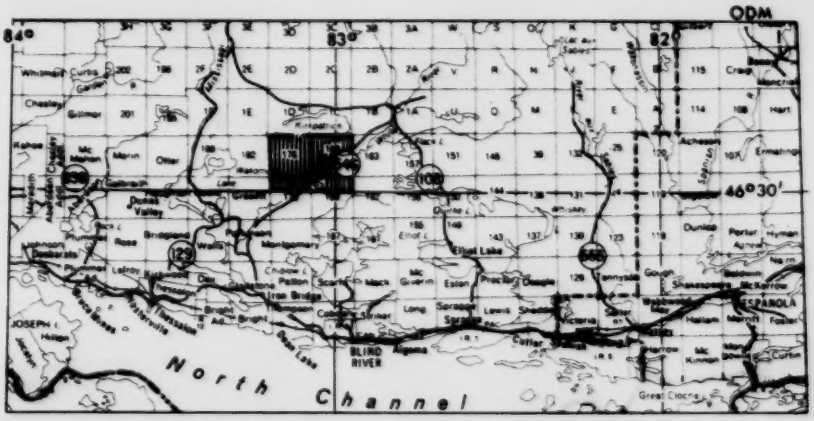
No.20 ENDIKAI LAKE AREA

DISTRICT OF ALGOMA

by

Krystyna M. Siemiatkowska[1]

LOCATION: The area consisting of Albanel Township (formerly Township 169), Varley Township (formerly Township 176) and northern parts of Kamichisitit Township (formerly Township 168) and Nouvel Township (formerly Township 175),



LOCATION MAP Scale: 1 inch to 25 miles

is situated approximately 29 miles (47 km) NE of Iron Bridge along Highway 546 and 35 miles (56 km) NW of Elliot Lake via Highways 108, 639, and 546. Primary access is by Highway 546, by boat from Endikai Lake, and by float-equipped aircraft via numerous lakes. A private lumber road under construction provides access to the SW part of the area.

MINERAL EXPLORATION: The area has been prospected for copper since the beginning of the century and for uranium since the Blind River uranium discovery in early 1950.

Recently the map-area was being actively explored and staking was done in winter of 1973/74. The main exploration was for copper mineralization.

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Albanel Township (formerly Township 169): In 1965, Canamiska Copper Mines Limited carried out geophysical and geochemical surveys on claims 1½ miles (2.4 km) southeast of south end of Endikai Lake. The survey indicated several magnetic and geochemical anomalies in arkose and conglomerate of the Gowganda Formation which were tested by trenching and 19 diamond drill holes totalling 4,748 feet (1447 m). In 1966, three more diamond drill holes were put down to test a shear zone with veins and blebs of pyrite, chalcopyrite and chalcocite. The east-striking mineralized zone was traced for a length of 2,000 feet (610 m), and channel samples from a trench averaged 0.8 percent Cu over a zone stated to be 9 feet 3 inches (2.82 m) in width (Assessment Files Research Office, Ontario Division of Mines, Toronto, and Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

In 1955, Midrim Mining Company Limited put down four diamond drill holes for a total of 1,645 feet (501 m) in a quartz carbonate shear zone west of Endikai Lake. The holes revealed a zone of altered carbonate containing specks of hematite, pyrite, chalcopyrite and bornite (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1955, A.E. Roser diamond drilled one hole for 410 feet (125 m) in the Espanola Formation and diabase in the eastern end of Albanel Township (formerly Township 169) south of Little White River; no mineralization was encountered (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). In 1952 and 1956, Stanford Mines Limited did limited work on the border between Albanel Township and Nicholas Township (formerly Township 163); then in 1965, an electromagnetic and magnetic survey was done plus a diamond drill hole to a depth of 453 feet (138 m) in arkose. In 1971, trenching and sampling over a shear zone about 6 feet (2 m) wide, striking N20E for 55 feet (17 m) wide, gave assays of 7.45 percent Cu, 1.6 percent Cu and 0.28 ounce of Ag per ton and 0.15 ounce of Ag per ton respectively. In 1972, further diamond drilling encountered sparse mineralization (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1952, Teck Exploration Company Limited put down eight diamond drill holes in diabase for a total of 727 feet, west of Endikai Lake. The drilling encountered very scattered chalcopyrite assocaited with hematite in quartz stringers associated with a shear zone (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1955, US-CA-Mex Explorations Limited diamond drilled 1,947 feet (593 m) in granite and diabase on the norhtwest shores of Endikai Lake. Assays of drill hole samples averaged 0.5 percent Cu with a maximum of 0.82 percent Cu. In 1970, further stripping, trenching, and geological mapping by US-CA-Mex Explorations Limited exposed a diabase-quartzite contact alteration zone with chalcocite, chalcopyrite, and hematite-quartz-bearing zones (Assessment Files Research Office, Ontario Division of Mines, Toronto).

During the summer of 1974, a ground magnetic and electromagnetic survey was done on active claims of Fort Norman Explorations Incorporated south of Little White River. Four holes were diamond drilled in the Espanola Formation and diabase during the winter of 1973-74 (R. Rupert personal communication) to test a copper zone in the Espanola Formation.

The White River lead prospect located 2-3/4 miles (4.4 km) east of the south end of Endikai Lake, has not been worked since 1928 and 1929 when surface work was done and an adit was driven for 175 feet (53 m) with 354 feet (108 m) of crosscutting by Sudbury Basin Mines Limited (Shklanka 1969).

In 1955, Picton Uranium Mines Limited drilled four diamond drill holes for a total of 1,631 feet (497 m) in Mississagi arkose north of Highway 546 in the east end of Albanel Township (formerly Township 169). In 1968, Parsons and Baker did detailed mapping over the radioactive Mississagi quartzite with selective samples assaying 0.04 percent U_3O_8 (Assessment Files Research Office, Ontario Division of Mines, Toronto, and Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). In 1969, The Hanna Mining Company diamond drilled to a depth of 3,002 feet (915 km) north of Little White River intersecting a few narrow weakly radioactive conglomerate beds (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1966, Falconbridge Nickel Mines Limited put down two diamond drill holes in the Gowganda Formation half way between Mistaken Lake and Little White River for a total of 739 feet (225 m). No mineralization was encountered (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). In 1967, Triller Explorations Limited conducted a magnetometer survey in the southeastern part of the Township and in 1968, two holes were diamond drilled to a depth of 1,543 feet (470 m) and 3,034 feet (925 m) in diabase. In the second hole, sections between 3,010 and 3,012 feet (917.4 to 918.1 m) assayed 0.03 percent U_3O_8 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

Kamichisitit Township (formerly Township 168): In 1965, Cana Exploration Consultants Limited performed geochemical and geophysical surveys for Pathfinder Copper Mines Limited in the northern part of the Township. Subsequently, eight diamond drill holes showed a very small amount of copper mineralization in a quartz-carbonate breccia zone (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1966 North Summit Explorations Limited did a combined magnetic and electromagnetic survey and in 1967, 1,750 feet (533 m) were diamond drilled to investigate the extension of copper mineralization area below a known copper zone drilled by the company in 1966. Two narrow zones of copper mineralization separated by 30 feet (9 m) of barren material were intersected assaying 1.85 percent Cu over 2.5 feet (0.76 m) and 2.4 percent Cu over 2 feet (0.61 m) (Assessment Files Research Office, Ontario Division of Mines, Toronto). Further geochemical work was carried out on the property.

In 1928 to 1929, trenching and 21 diamond drill holes were put down for a total of 6,557.5 feet (1999 m) in the Gowganda Formation on the Copper Prince Prospect by The Consolidated Mining and Smelting Company of Canada Limited. In 1947, the same company did a geological survey of the area. No further work was done till 1951-52 when Copper Prince Mines Limited diamond drilled four holes for a total of 1,638 feet (499 m) and did a geological survey of the area (Shklanka 1969).

Varley Township (formerly Township 176): In 1955, Beaucoeur Yellowknife Mines Limited mapped the surface geology south of Wilson Lake. A hole was diamond drilled to a depth of 952 feet (290 m) in an attempt to find a uranium-bearing conglomerate horizon (Assessment Files Research Office, Ontario Division of Mines, Toronto).

In 1967, Falconbridge Nickel Mines Limited diamond drilled two holes for 2,321 (707 m) and 2,351 feet (717 m) in the Gowganda Formation southwest of Waterhole Lake and south of Bridge Lake, and in 1970, one hole for 950 feet (290 m) south of Jess Lake. No mineralization was encountered (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). In 1969, First National Uranium Mines Limited did surface mapping and ground magnetometer and radiometric surveys in the southwestern part of the Township.

Nouvel Township (formerly Township 175): In 1968 Pacific Petroleums Limited drilled a hole south of Little White River 4,345 feet (1324 m) through the Gowganda Formation to the Mississagi quartzite; no mineralization was encountered (Assessment Files Research Office, Toronto).

GEOPHYSICAL AND GEOCHEMICAL SURVEYS: In 1968, Seigel Associates Limited carried out for Atlantic Richfield Canada Limited, an airborne electromagnetic magnetic and radiometric survey in the Flack Lake area. In 1965, Cana Exploration Consultants Limited did geophysical and geochemical surveys for Latcham Enterprises Limited in the northwestern part of Kamichisitit Township (formerly Township 168). In 1967, Canadian Aero Mineral Surveys Limited did an airborne electromagnetic and magnetometer survey in the Elliot Lake region for Cominco Limited. In 1968, Huntec Limited and Lockwood Surveys Limited did an airborne geophysical survey of the Blind River area for Radex Syndicate. In 1968, McPhar Geophysics did separate airborne magnetic and electromagnetic surveys for Pacific Petroleums Limited and for Fidelity Mining Investments Limited; and in 1970, for David S. Robertson and Associates Limited. In 1968, Metals, Petroleum and Hydraulic Resources Consulting Limited did an airborne geophysical survey of parts of Albanel Township (formerly Township 169) and Nouvel Township (formerly Township 175) for Subeo Limited (Assessment Files Research Office, Ontario Division of Mines, Toronto).

GENERAL GEOLOGY: The map-area is located at the contact between the Superior and Southern Provinces of the Canadian Shield. The rocks of the area, previously mapped by Emmons (1927), can be subdivided into six major units: (1) Early Precambrian metavolcanics, paragneiss, and orthogneiss; (2) Early Precambrian felsic plutonic rocks; (3) Early Precambrian mafic intrusions; (4) Middle Precambrian sedimentary rocks of the Huronian Supergroup; (5) Middle Precambrian, post-Huronian mafic intrusions; and (6) Cenozoic, Pleistocene, and Recent unconsolidated sediments.

Fine-grained, dark green, foliated, mafic metavolcanics cut by pink granitic dikes occur southeast of Endikai Lake. The orthogneiss and paragneiss are found as irregular remnants in the granitic basement rocks. The orthogneiss shows well developed gneissosity with typical segregation of granitic and mafic minerals into bands. The paragneiss is dark grey to black. In places, sedimentary bedding can still be observed. These gneisses are readily subdivided in the field into metasedimentary and metavolcanic origin on the basis of their composition and primary structure. All gneisses are cut by late-stage pink granitic dikes.

The felsic plutonic rocks of the Superior Province are grey to pink, massive to porphyritic granitic rocks. For the most part, they are hornblende-bearing foliated granites, however, leucocratic varieties with less than 5 percent mafic minerals are present in the western part of the area. Xenoliths of older metasedimentary and meta-igneous rocks are preserved in the granites. Narrow aplitic and pegmatitic dikes cut the granites throughout the area.

A swarm of narrow dikes intruding the basement rocks were classified into two major types: a northwest trending set of porphyritic diabase dikes probably of Matachewan type; and fine-grained amphibolitic diabases similar to the later Nipissing gabbro bodies which intrude the Huronian rocks. However, these dikes are probably pre-Huronian since they do not appear to cut the Huronian rocks.

The Huronian Supergroup unconformably overlies the Early Precambrian granitic basement rocks. The unconformity is well exposed in Varley Township (formerly Township 176) north of East Twin Lake, West Twin Lake, and Bridge Lake. At the unconformity a granitic regolith is overlain by basal conglomerate which grades into Mississagi arkose north of Bridge Lake and Bruce conglomerate north of East Twin Lake.

The lowermost formation of the Huronian Supergroup exposed in the area is the Mississagi Formation. In Varley Township (formerly Township 176) green arkose overlies the granitic basement whereas in Albanel Township (formerly Township 169) it occurs in the core of an anticline north and south of Little White River. Within the anticline, the Mississagi arkose is slightly radioactive, coarse- to medium-grained, green to pink, and thickly bedded. Near the top it becomes pinker and finer-grained and is interbedded over 10 feet (3 m) with the Bruce Formation. The Bruce Formation consists of polymictic paraconglomerate with siliceous, pyrite-bearing protoquartzite matrix. Sandy and argillaceous interbeds and lenses occur near the top of the sequence. The contact with the overlying Espanola Formation is sharp and conformable. The Espanola Formation was divided into three members: (1) limestone with thin silty interbeds; (2) finely laminated greywacke; and (3) a protoquartzite to calcareous sandstone interbedded with laminated argillite. The limestone is creamy to light grey in colour and is strongly deformed, obliterating primary structures. The siltstone interbeds show well developed boudin structures.

The greywacke is finely laminated at the bottom with well developed intraformational breccia. Towards the top the thinly bedded greywackes show ripple marks, flame structures, and slump features. The greywacke gets progressively coarser grained and grades into the protoquartzite and calcareous sandstone member. The interbeds of laminated argillite occur at the bottom and disappear towards the top. The calcareous sandstone is laminated to massive, pink to grey, feldspathic sandstone with calcareous, brown-weathering spots.

The conformably overlying Serpent Formation is the most diversified Formation in the area. It is absent southeast of Narrow Lake and where present in other places, it changes lithologically on strike from one area to another. In Albanel Township (formerly Township 169), the Serpent Formation appears as very massive sandstone with pseudoporphyritic feldspar and quartz grains. No structure was observed in this massive rock. East of Bridge Lake, and East Twin Lake the Formation ranges from orthoconglomerate in the west to calcareous to non-calcareous sandstone in the east.

The Gowganda Formation overlies the Serpent Formation, and where that Formation is absent, overlies the Espanola Formation. The Gowganda Formation is a heterogeneous assemblage of orthoconglomerate, paraconglomerate, laminated argillite and sandstone, covering most of the southwest part of the map-area. The orthoconglomerate and paraconglomerate consist of pink to grey granitic pebbles, cobbles and boulders in a sandstone- to argillite-matrix. The laminated argillite shows drop stones, and slump balls of sandy material are quite common throughout the sequence. The top of the Gowganda Formation consists of pink feldspathic sandstone.

A gradational contact of approximately 100 feet (30 m) true thickness exists between the sandstone of the Gowganda Formation and the overlying Lorrain Formation. The Lorrain Formation was subdivided into six main members, with gradational contacts, which from the base are: (1) basal purple sandstone; (2) pink hematitic pebbly sandstone; (3) quartz, jasper pebble conglomerate; (4) fine-grained hematitic sandstone, (this unit was used as a marker horizon); (5) pink to buff pebbly sandstone; and (6) white orthoquartzite.

The conformably overlying Gordon Lake Formation consists of three members: (1) a basal pink to reddish sandstone and siltstone, fine-grained with prominent ripple marks and slump structures; (2) a green to brown finely bedded siltstone, argillite, and cherty sandstone with intraformational breccia horizons, mud cracks, load casts, ripple marks, and flame structures; and (3) a sandy, hematite-rich, finely bedded greywacke which is overlain by the Bar River Formation. The Bar River Formation consists of massive, thickly bedded and cross-bedded, white to pink orthoquartzite which becomes thinly bedded towards the top with prominent ripple marks. The top of the Bar River is not exposed in the map-area.

The Huronian sedimentary rocks and the Early Precambrian granite are intruded by bodies and dikes of Nipissing-type gabbro. These intrusions range from fine-grained at chilled contacts, to coarse-grained amphibolites. Fresh pyroxene-bearing gabbro and granophyre were observed in some of the larger bodies. A fine-grained variety of small diabase dikes intruding the Huronian sedimentary rocks are rich in epidote and disseminated pyrite. They postdate the Nipissing diabases.

The youngest intrusion is an olivine diabase dike of the Sudbury swarm.

Structure: The Flack Lake, Endikai, and Pearl Lake faults, the major fault structures of the map-area, probably belong to one east-striking regional fault system. Movement on these faults, as well as numerous subsidiary faults, resulted in formation of a series of rotated fault bound blocks. Structurally the area can be divided into six parts: (1) the granitic basement and the Lorrain Formation north of Endikai Lake fault; (2) a wedge of Cobalt sedimentary rocks pinching out to the west and bounded on the north by Endikai Lake fault and on the south by the Flack Lake fault; (3) a block, of granite and Huronian sedimentary rocks from the Mississagi to Gowganda Formations and bounded on the north by the Flack Lake fault and on the south by the Pearl Lake fault; (4) the Wakomata Lake syncline with a westerly plunging fold axis; (5) the Quirke Lake syncline with an easterly plunging fold axis; and (6) an area in east-central Albanel Township (formerly Township 169) consisting of an anticline and a series of small fault-bounded blocks of sedimentary rocks. Area (4) can probably be considered as part of the Quirke Lake syncline the axis of which is doubly plunging to produce a canoe-shaped fold.

ECONOMIC GEOLOGY: Copper occurs at numerous localities in the map-area in the form of chalcopyrite, chalcocite, and malachite associated with specularite-bearing quartz-carbonate veins that are, in turn, associated with shear zones and Nipissing-type diabase intrusions. The most important are:

White River Lead Prospect: A quartz-carbonate vein, striking N70W, is located 2 3/4 miles (4.4 km) east of the south end of Endikai Lake. The vein is 3 to 6 feet (1 to 2 m) wide and has been traced for 500 feet (152 m) on surface; it is mineralized with pyrrhotite, chalcopyrite, and galena. A shoot in the adit approximately 80 feet (24 m) long and 7 feet (2.1 m) wide averaged 7.6 percent Pb, 1.0 percent Cu, and 2.3 ounces of Ag per ton (Shklanka 1969). Five selected grab samples, collected by the author, yielded*:

(i) 0.10 oz/ton Au, 3.46 oz/ton Ag, 1.56% Cu, 0.63% Pb, 0.26% Zn, 0.1% Co, 0.05% Bi;
(ii) 0.45% Cu, 0.5% Pb;
(iii) 0.62 oz/ton Ag, 0.28% Cu, 0.67% Pb, 0.53% Zn, 0.13% Co;
(iv) 5.34 oz/ton Ag, 1.07% Cu, 36.6% Pb, 0.05% Bi;
(v) Trace of Au, 1.02 oz/ton Ag, 0.59% cu, 0.14% Pb, 0.10% Co.

*Analyses by Mineral Research Branch, Ontario Division of Mines.

Fort Norman Explorations Incorporated Showing: Chalcopyrite, pyrite, malachite, and azurite occur in a silicified shear zone striking around N65E and dipping 65S in the Espanola Formation some 300 feet (91 m) away from a Nipissing diabase body. Chalcopyrite occurs as replacement along fractures and as massive blebs associated with quartz, carbonate and chlorite. The exposed mineralized zone is about 50 feet (15 m) wide and 100 feet (30 m) long. A 1 foot (0.3 m) wide magnetite-bearing band can be seen in the north part of the showing. Three grab samples taken by the author assayed traces of Au and Ag, and 0.68 percent Cu, 1.29 percent Cu, and 5.35 percent Cu respectively; one sample contained 0.09 percent Co*.

Endikai Lake Prospect: On the west shore of Endikai Lake, ½ mile (0.8 km) south of the north end of the lake, a stockwork of small quartz veins striking about N75W to N70W with vertical to steep southerly dips occur in an alteration zone at a contact of Nipissing diabase and sandstone of the Gordon Lake Formation. The veins, from 1 to 5 cm thick, carry chalcocite, chalcopyrite and hematite. The mineralized zone has been traced by drilling for 3,000 feet (914 m) (Shklanka 1969). Grab samples taken during the mapping project assayed 0.15 ounce of Ag per ton and 0.92 percent Cu*.

North Summit Prospect: In Kamichisitit Township (formerly Township 168) 1,500 feet (457 m) northeast of Rackey Lake a 15 to 20 feet (4.6 to 6 m) wide network of quartz veins trending N80W with vertical dips occurs in a highly fractured and sheared zone in the conglomerate of the Gowganda Formation (Shklanka 1969).

Copper Prince Prospect: In Kamichisitit Township (formerly Township 168), 500 feet (152 m) west of the west end of Rackey Lake a 50 foot (15 m) wide quartz vein striking N75E for about 1,000 feet (300 m) with vertical dip, cuts the arkose of the Gowganda Formation. The vein occurs in a chloritic shear zone and carries mineralization in the form of pyrite, chalcopyrite, chalcocite, and specularite. Two grab samples collected during the mapping project assayed nil and 0.02 ounce of Au per ton; trace and 0.44 ounce of Ag per ton; and 1.86 percent and 13.2 percent Cu respectively*.

Three other occurrences of the same type were observed in the map-area: (1) On the east boundary of the map-area in central Albanel Township (formerly Township 169) quartz-carbonate-bearing veins striking north and N85W occur in a shear zone in Lorrain sandstone, which is cut by numerous diabase dikes. Chalcopyrite, malachite, azurite, and specularite are associated with the quartz and carbonate. Two grab samples taken by the author assayed, nil and 0.02 ounce Au per ton; nil and 0.36 ounce Ag per ton; 0.11 percent Cu and 15.6 percent Cu, and 0.24 percent Zn and nil respectively*. (2) In Albanel Township (formerly Township 169) north of Little White River a shear zone 100 feet (30 m) wide striking N55E and dipping 55W, consists of quartz and

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*Analyses by Mineral Research Branch, Ontario Division of Mines.

chlorite with pyrite-rich areas. Two grab samples taken by the author during the field season assayed nil and trace Au, nil and 0.52 ounce Ag per ton; and 0.13 percent and 0.14 percent Cu respectively. A 10 foot (3 m) wide quartz vein sampled proved to be barren*. Northeast of Long Lake a shear and breccia zone about 10 feet (3 m) wide and 500 feet (150 m) long contains disseminated pyrite and chalcopyrite in a quartz vein. Grab samples taken by the author during 1974 assayed traces of Ag and 2.6 percent Cu*.

Radioactivity was noted in the Mississagi arkoses north of the Little White River. A scintillometer survey of the area by the author indicated readings above background in some areas.

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Shklanka, R.
1969: Copper, Nickel, Lead and Zinc Deposits of Ontario; Ontario Department of Mines, MRC12, 394p.

*Analyses by Mineral Research Branch, Ontario Division of Mines.

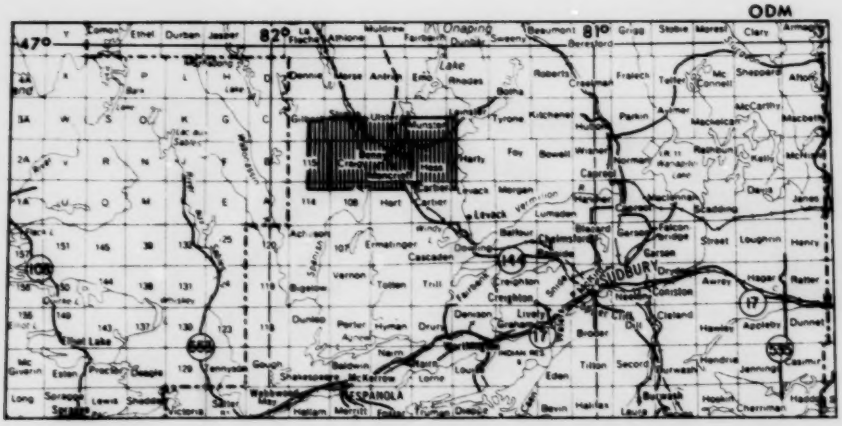
No.21 BENNY AREA

DISTRICT OF SUDBURY

by

K.D. Card[1] and D.G. Innes[2]

LOCATION: The Benny area, located some 40 miles (64 km) northwest of Sudbury, Ontario, is bounded by Latitudes 46°42'N and 46°51'N and Longitudes 81°26'W and 81°53'W. In 1973, the eastern half of this area was mapped and



LOCATION MAP Scale: 1 inch to 25 miles

the results of that mapping were published in the form of 1 inch to ¼ mile preliminary maps (Card and Innes 1974a; 1974b). During the 1974 field season the western half of the area, including Craig Township and parts of Moncrieff, Ulster, Hart, Gilbert, Stralak, Tofflemire (formerly Township 108), Solski (formerly Township 114), and Ouellette Township (formerly Township 115) were mapped at a scale of 1 inch to ¼ mile. In addition, areas in the eastern half of the map-area were mapped or remapped to fill gaps in 1973 coverage.

Parts of the area were previously mapped by Quirke (1920), Osborne (1929), and Holmes (1953).

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[2]Resident Geologist, Ontario Ministry of Natural Resources, Sudbury.

MINERAL EXPLORATION: Exploration for base metals, iron, gold, and uranium has been carried out at a number of localities within the area. The Lake Geneva Mine in Hess Township produced some 10,400,000 pounds of zinc, 3,600,000 pounds of lead, and silver valued at $28,416 in the 1940s (Card and Innes 1973). During the 1974 field season the mine was being prepared for testing and possible future production by Devon Resources Limited. There are numerous stratabound sulphide deposits (see "Economic Geology") in the Early Precambrian metavolcanic-metasedimentary sequence, i.e. the Benny belt. Several have been tested by trenching, drilling, and geophysical methods. The dominant sulphide minerals in most are pyrite and pyrrhotite, but deposits of this type in Craig Township, the Stralak deposit, contain appreciable amounts of zinc, lead, and copper sulphides.

Replacement-type deposits consisting of variable proportions and combinations of magnetite, chalcopyrite, and sphalerite occur in calcareous rocks of the Huronian Espanola Formation in southwestern Hess Township, south-central Munster Township, and northern Hart Township (See "Economic Geology"). Magnetite veins also occur in granitic rocks in central Hess Township and in Huronian rocks in northeastern Hess Township.

In east-central Hess Township a mafic dike which is probably part of the Foy offset, an offshoot dike from the Sudbury Nickel Irruptive, contains nickel-copper sulphides (Card and Innes 1973).

GENERAL GEOLOGY: The Benny map-area is located in the southern part of the Superior Province a short distance north of the Sudbury Nickel Irruptive. This area has been affected by both Early and Middle Precambrian depositional and orogenic events. The major rock groups include Early Precambrian metavolcanics and related metasediments, Early Precambrian mafic and felsic intrusions of several ages, and Middle Precambrian metasediments of the Huronian Supergroup. Middle Precambrian Nipissing Diabase intrusions and Late Precambrian diabase dikes are prevalent. Breccia bodies of several types and ages are present.

The Early Precambrian metavolcanic and metasedimentary rocks of the Benny belt form an east-trending belt up to 2 miles (3 km) in outcrop width that extends through and beyond the boundaries of the map-area. The sequence, which is bordered by intrusive granitic and migmatitic rocks, dips steeply southward and has a maximum preserved thickness of at least 10,000 feet (3000 m). The western one-third of the belt, which averages about 8,000 feet (2400 m) in outcrop width consists mainly (70 percent) of massive and pillowed mafic flows with lesser amounts of intercalated mafic and intermediate pyroclastic rocks (lithic, lapilli, ash tuffs) and minor felsic tuffs (lithic, crystal, lapilli tuff) and tuffaceous metasediments in the southern part of the belt. In addition there are several sill-like metagabbro intrusions in the western part of the belt.

The central part of the Benny belt consists of approximately 30 percent mafic flows, commonly with pillows and amygdules, and mafic pyroclastics, about 50 percent intermediate metavolcanics, mainly tuffs and agglomerate (tuff-breccia, block-tuff) with some volcanogenic metasediments, and approximately 20 percent felsic metavolcanics, mainly lithic and crystal tuffs of rhyolitic composition. The metasediments present include greywacke and siltstone, some recrystallized chert, one unit of oxide-facies iron formation, a carbonate-rich (carbonate-facies iron formation?) unit, and several thin graphitic siltstone lenses. There are cyclic repetitions of mafic, intermediate and felsic metavolcanics, commonly with sulphide-bearing tuffs and tuffaceous metasediments forming the contact zones between mafic or intermediate and felsic metavolcanic units. The stratabound sulphides, mainly pyrite and pyrrhotite, form stratiform disseminations, veins, and massive lenses. There are four to six mafic to felsic cycles each with associated sulphide-bearing units in the central part of the belt.

In the eastern third of the Benny belt, there are cyclic repetitions of mafic, intermediate and felsic metavolcanics and associated sulphide-bearing metasediments and tuffs in the north. Intermediate tuffs and tuffaceous metasediments are dominant (approximately 50 percent), followed by felsic metavolcanics (30 percent), mainly rhyolitic tuffs, with some porphyritic flows, and by mafic flows and pyroclastics (20 percent). The southern part of the belt in this area consists mainly of intermediate agglomerate (tuff-breccia, block-tuff).

The rocks of the Benny belt have been regionally metamorphosed, under conditions ranging from the lower greenschist facies in the central part of the belt to amphibolite facies in the marginal portions.

The felsic plutonic rocks which surround and intrude the metavolcanics can be divided into two main groups: an older gneissic, granodioritic-migmatitic complex that occurs mainly to the north of the metavolcanic belt; and younger, relatively massive, homogeneous quartz monzonite which forms most of the terrain to the south. Numerous xenoliths and schlieren of mafic to intermediate orthogneiss and paragneiss occur in the felsic plutonic rocks, especially north of the metavolcanic belt. In the eastern and western parts of the map-area to the north of the Benny belt there are extensive areas of migmatite consisting of variable proportions of metavolcanics, metasediments, and felsic intrusive material. In addition, there are very coarse-grained porphyritic felsic plutons and dikes, and irregular bodies of pegmatite along the southern margin of the Benny belt, and porphyritic granodiorite, diorite, and gabbro bodies in the north.

Early Precambrian mafic intrusions of several ages are present: sill-like metagabbro intrusions and a few small metagabbro dikes that, like the metavolcanics in which they occur, are foliated; and massive equigranular and porphyritic mafic dikes that form ramifying swarms in the Early Precambrian metavolcanics and granitic rocks.

The Middle Precambrian Huronian metasediments that form a discontinuous cover unconformably overlying the Early Precambrian basement occur mainly in the eastern half of the map-area and are described by Card and Innes (1973). During the 1974 field season, quartz sandstone, conglomeratic sandstone, and quartz-jasper pebble conglomerate of the Lorrain Formation were mapped in northeastern Tofflemire Township (formerly Township 108), and rocks of the Espanola, Serpent, Gowganda, and Lorrain Formations were mapped in north-central Hart Township. The Huronian rocks are in unconformable and fault contact with the Early Precambrian basement rocks and are intruded by Nipissing Diabase.

Nipissing Diabase intrusions, consisting of pyroxene and hornblende gabbro and metagabbro, intrude all the foregoing rock units, especially the Huronian rocks with which they appear to be spatially related. Mafic intrusions of the Nipissing type are notably rare in areas in which Huronian rocks are absent.

A mafic dike (quartz gabbro or diorite) in Hess Township which was described previously by Card and Innes (1973) and tentatively considered to be part of the Foy Offset of the Sudbury Nickel Irruptive, was traced eastward into Harty Township to a point near the Onaping River.

Breccias, both of the Sudbury or pseudotachylite type, and others containing mafic rock fragments in a matrix rich in biotite and magnetite, are present throughout the area. A few small lamprophyre dikes were noted. The youngest rocks in the area, diabase dikes, form part of a regional northwest-trending dike swarm.

The bedrock is extensively mantled by boulder till, moraine, valley train outwash, and esker deposits, the products of Pleistocene glacial and glaciofluvial processes. Large glacial erratics and boulder trains are present. Glacial striae on bedrock trend S10W to S20W.

STRUCTURAL GEOLOGY: Primary stratification in the Early Precambrian metavolcanic sequence strikes east and dips steeply southward for the most part. Although minor folds are present, no major fold repetitions were discerned, and it is probable that these rocks generally face southward. The dominant tectonic foliation, a regional penetrative cleavage or schistosity, is subparallel to primary stratification and is associated with flattening and alignment of pillows, lithic fragments, and minerals. These elements are shortened in the north-south direction normal to the foliation plane, and elongated east-west; down-dip elongation in the foliation plane gives rise to a rodding lineation. Deformed pillows and lithic fragments have the form of triaxial ellipsoids with axial ratios on the order of 1:10:15. Foliation in the felsic plutonic rocks, in the form of penetrative cataclastic cleavage and gneissosity, strikes generally east-west and dips steeply both north and south.

The Huronian supracrustal rocks have been tectonically deformed but the intensity of this deformation, along with the orientation of fold structures, is highly variable from place to place. Middle Precambrian deformation was apparently dominated by vertical movements on fault-bounded basement blocks and consequent passive deformation of the Middle Precambrian cover.

Fault sets striking northwest, northeast, north-northwest and north-northeast are present. Movements on major northwest and north-northwest faults such as those along the Spanish River, Kennedy Lake, and the Agnes River have resulted in progressive northward displacements of the Benny belt from east to west.

ECONOMIC GEOLOGY:

Mineral occurrences in the eastern half of the map-area have been described previously (Card and Innes, 1973). Included are the Lake Geneva Mine zinc-lead-silver deposit in Early Precambrian metavolcanic rocks in Hess Township, a zinc-lead-copper deposit in carbonate rocks of the Espanola Formation in central Hess Township, magnetite deposits in the Espanola in southern Hess and southern Munster Townships, nickel-copper sulphide minerals in the Foy Offset, Hess Township, and very minor amounts of fluorite and molybdenite in felsic plutonic rocks in Moncrieff Township.

Stratabound Sulphide Deposits in Metavolcanic Rocks: Deposits of this type are present throughout the area, and in the western half most of the known deposits are of this type. They are typically stratabound volcanogenic deposits of sulphide minerals, chiefly pyrite and pyrrhotite with variable amounts of sphalerite, chalcopyrite, and galena locally, in siliceous metasediments and felsic and intermediate pyroclastics in the transitional contact zones between mafic and felsic metavoalcnics. The sulphide minerals occur as massive layers or lenses up to 10 feet (3 m) thick, as stratiform disseminations, and in veins and quartz-carbonate replacement zones. The Lake Geneva Mine deposit is probably of this type although structural complication and the presence of numerous igneous intrusions in the area make genetic interpretation difficult.

Stralak Deposit: The Stralak deposit in northeastern Craig Township consists of stratabound sulphide mineralization along a mafic metavolcanic-felsic metavolcanic contact extending westward from the Canadian Pacific railway at Stralak. Two zones of sulphide mineralization occur along this contact: an eastern zone about 1,500 feet (500 m) long and 10 feet (3 m) wide with massive sulphide lenses up to 6 feet (2 m) thick; and a western zone about 1 mile (1.6 km) west which is 600 feet (200 m) long and up to 6 feet (2 m) wide. The disseminated sulphides, mainly pyrite and pyrrhotite with minor chalcopyrite and sphalerite, occur in foliated, micaceous tuffaceous rocks and siliceous metasediments. The massive sulphide lenses consist of pyrite and sphalerite with lesser amounts of galena and chalcopyrite. The sulphides, like their host rocks, are strongly foliated and lineated.

Exploration work consisting of surface trenching, diamond drilling, and geological and geophysical surveys, mainly by Preston East Dome Mines Limited in 1952 and by Mining Corporation of Canada (1964) Limited in 1964-65, has outlined some 363,680 tons of material grading 3.18 percent Zn, 0.32 percent Cu, and 0.68 oz/ton Ag over an average width of 8.6 feet (2.6 m) to a depth of 157 feet (48 m) (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury). The Stralak deposit occurs near the northern margin of the Benny belt at approximately the same stratigraphic level as the Lake Geneva mine.

Other Stratabound Sulphide Deposits: There are numerous other stratabound sulphide deposits, apparently consisting mainly of pyrite and pyrrhotite, at mafic metavolcanic-felsic metavolcanic contacts throughout the area. There is a prominent zone of such sulphide-bearing units in the southern part of the belt that extends from central Moncrieff Township through Craig Township to the northeastern corner of Ouellette Township (formerly Township 115). Individual zones with disseminated sulphides are up to 100 feet (30 m) thick and within these zones there are lenses of massive pyrite and pyrrhotite up to 5 feet (1.5 m) thick. In northwestern Craig Township and northeastern Ouellette Township (formerly Township 115), sulphides are associated with carbonate-rich and graphitic metasediments.

Replacement Deposits in Huronian Rocks: Replacement, vein-type deposits in Huronian metasediments, near Nipissing Diabase intrusions, that consist of (a) pyrite, sphalerite, galena, and chalcopyrite in central Hess Township; (b) magnetite and chalcopyrite in southern Hess Township; and (c) magnetite and pyrite in southern Munster Township, have been described previously (Card and Innes 1973).

Hart Township Deposit: A replacement-type deposit in Huronian metasediments containing zinc, lead, cobalt, and nickel occurs in northern Hart Township. In Lots 7 and 8, Concession V, Hart Township, brecciated, contact metamorphosed rocks of the Espanola and Serpent Formations contain veins, disseminations, and pods of mineralization erratically distributed in a zone approximately 1,000 feet (300 m) in length near the contact of a Nipissing Diabase intrusion. The minerals present include magnetite, pyrite, sphalerite, galena, chalcopyrite, cobaltite, and smaltite. Gangue minerals in the carbonate-rich Espanola Formation rocks include diopside, wollastonite, and pectolite. Quartz-carbonate veins in the Nipissing Diabase near the contact contain pyrite, chalcopyrite, cobaltite, diopside, and tremolite. Exploration, including surface trenching, diamond drilling, and a geophysical survey, mainly by Mogul Mining Corporation Limited in 1955 and by Salem Exploration Limited in 1965, has outlined several zones of mineralization up to 4½ feet (1.4 m) thick containing 1.46 percent to 8.06 percent Zn, 0.11 percent to 1.30 percent Pb, 0.03 percent to 0.12 percent Cu, and 0.02 percent Co (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury).

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No.22 CAVENDISH AND ANSTRUTHER TOWNSHIPS

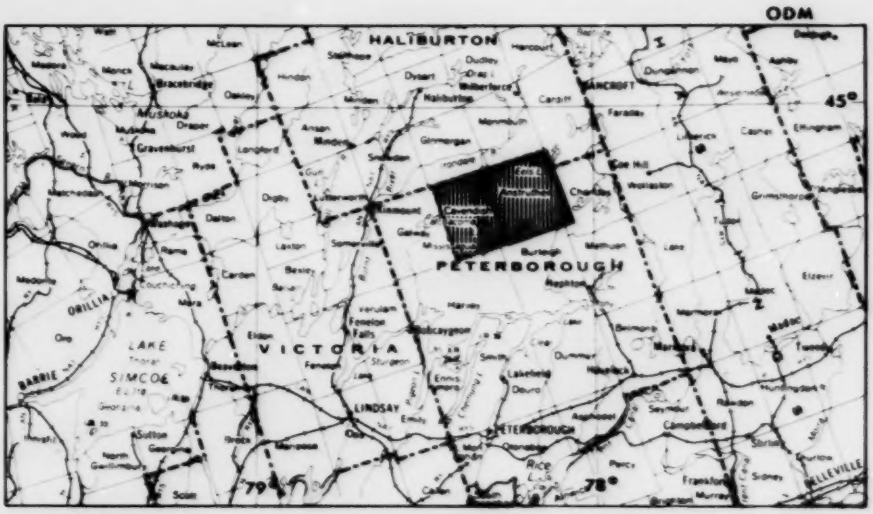
PETERBOROUGH COUNTY

SOUTHERN ONTARIO

by

E.G. Bright[1]

INTRODUCTION: During parts of June and August, a preliminary reconnaissance survey of Cavendish and Anstruther Townships plus portions of adjacent townships also within the Eels Lake map-area was carried out with the purpose of



LOCATION MAP Scale: 1 inch to 25 miles

outlining a detailed geological survey of Cavendish and Anstruther Townships for the 1975 field season. The mapping will be correlated and tied in with the previous geological mapping in this area by the ODM, e.g. Hewitt (1956; 1957; 1960; 1962), Hewitt and James (1955), ODM (1957), Armstrong and Gittens (1968), and Shaw (1962), to produce a 1 inch to 1 mile geological compilation of the Eels Lake area. The Eels Lake area corresponds to the NTS Gooderham

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sheet (31 D/16), southwest of Bancroft, comprising parts of Glamorgan, Cardiff, Faraday, Galway, Cavendish, Anstruther and Chandos Townships.

Location: Cavendish and Anstruther Townships, with an area of approximately 240 square miles (620 km^2), are located about 25 miles (40 km) southwest of Bancroft, in the extreme northeast corner of Peterborough County, southern Ontario. Primary access is by Highway 28, north from Peterborough or via Highways 36 and 507 north from Lindsay.

MINERAL EXPLORATION: Although the general area has been prospected for base metals, iron, industrial minerals since the turn of the century, and lately uranium, it was not until 1953 that the Townships of Anstruther and Cavendish underwent their greatest period of exploration. With the advent in 1953 of underground development at Bicroft Uranium Mines Limited (formerly the Centre Lake Uranium Mines Limited) in Cardiff Township immediately northeast of the map-area, Newkirk Mining Corporation Limited carried out a regional airborne scintillometer survey over a wide area surrounding and including the Anstruther and Burleigh granitic batholiths. Newkirk Mining Corporation Limited staked a block of 361 claims in southern Anstruther Township as well as the northern part of Burleigh Township, immediately to the south, and subsequently optioned some of the more prominent radioactive anomalies to various other mining companies. In 1954 and 1955 in Anstruther Township, Newkirk Mining Corporation Limited, Glenn Explorations Limited, Zenmac Metal Mines Limited and Farcroft Mines Limited, plus several other mining concerns carried out ground scintillometer and magnetometer surveys, geological mapping and in most instances diamond drilling programs. By 1955, almost all of the unpatented land in Cavendish Township was staked and under active exploration by such companies as Cavendish Uranium Mines Corporation, Drude Uranium Mines Limited, Silanco Mining and Refining Company Limited, Macfie Explorations Limited, plus several other mining companies.

In 1955-1956, Cavendish Uranium Mines Corporation sank an exploration shaft to 88 feet (27 m) and carried out lateral work and diamond drilling from the 70 foot (21 m) level on their uranium prospect near Catchacoma in Cavendish Township (Satterly 1956).

Because of a rapidly declining demand for uranium in the late 1950s, all development operations at the Cavendish mine were suspended in 1957. With this suspension, exploration throughout the area came to a halt. The period 1967-1969 saw a renewed interest and a higher demand for uranium such that a second major period of uranium exploration commenced in the area. The Cavendish mine, now owned by Amalgamated Rare Earth Mines Limited, was optioned to Asarco Exploration Company of Canada Limited. Asarco Exploration Company of Canada Limited drilled 13 holes on the mine property and feasibility studies confirmed the earlier tonnage estimates (Northern Miner 1968b). Renewed exploration activity on some of the other promising uranium prospects in the map-area were also carried out during this same period by Glenn Exploration Limited, Quebec Uranium Mining Corporation, Newlund Mines Limited, Louvicourt Goldfield Corporation, and Briar-Court Mines Limited.

At the present time, the Cavendish uranium deposit of Amalgamated Rare Earth Mines Limited is being re-evaluated by Imperial Oil Limited (Northern Miner 1974a) and the magnetite skarn deposit in the northeast part of Anstruther Township is undergoing development drilling by Biron Bay Gold Mines Limited (Northern Miner 1974b).

GENERAL GEOLOGY: The map-area is located in the southern part of the Grenville Province along the physiographic boundary between the Haliburton-Hastings Highlands and the Hastings Basin. This same topographical feature coincides approximately with the regional north-northeast trending Harvey-Cardiff tectonic arch, a lineal series of four granitic bodies, the Burleigh, Anstruther, Cheddar and Cardiff batholiths. Metalogenically this arch forms the axis of the Bancroft-Haliburton Uranium Belt of which Cavendish and Anstruther Townships form the main southwestern extension.

Earlier investigations, and reconnaissance mapping this year shows that the oldest rocks in the area are Late Precambrian marble, paragneiss, amphibolite, quartzo-feldspathic gneiss and quartzite of the Grenville Supergroup (Wynne-Edwards 1972). These 1700(?)-1200 million year old supracrustal rocks were deposited on an unexposed basement complex as limestone, sandy and limy shale, siltstone and sandstone which subsequently underwent regional metamorphism to almandine amphibolite facies rank. Most of Cavendish Township and the eastern portion of Anstruther Township are underlain by Grenville metasediments of the Mayo Group (Hewitt 1957) and(or) the Mayo and the upper part of the older Hermon Group (Lumbers 1967), the youngest subdivisions of the Grenville Supergroup of metasediments and metavolcanics. Marble, micaceous marble, diopsidic marble and associated calcsilicate rocks are the most abundant metasedimentary units in the map-area, followed by biotite paragneiss, hornblende-biotite paragneiss, amphibolite gneiss, quartzo-feldspathic gneiss and quartzite respectively. Some of the medium- to coarse-grained amphibolites observed in the southwestern part of Cavendish Township could be metamorphosed mafic volcanic or gabbroic rocks. These rocks form an almost complete mantling envelope around the Anstruther batholith, a younger, oval-shaped gneissic granitic body which underlies most of the eastern portion of the map-area. A pronounced foliation exhibited throughout the metasedimentary units, parallels the compositional layering and would appear to reflect original bedding accentuated by metamorphic and granitic segregation.

The metasediments in the western part of Cavendish Township, particularly those in the northwestern part, contain conformable sheet-like intrusive bodies of gabbro, gneissic syenite and syenite-granite gneiss which predate the metamorphism and emplacement of the Anstruther batholith, a body formed by successive stages of granitic upwelling, lit-par-lit injection and granitization of the metasediments. Lithologically the potassic Anstruther batholith consists of a complex mixture of pink leucogranite gneiss, grey hybrid granite gneiss, migmatite, pink pegmatitic granite, granite pegmatite and numerous screens of relict Grenville 'series' rocks.

A period of intense deformation, metamorphism and anatexis accompanied the emplacement of the Anstruther batholith between 1200 and 950 million years ago. During the late stages of deformation and regional metamorphism, concordant and discordant leucocratic pegmatites as well as some complex uranium-bearing pegmatites intruded the entire metamorphic complex throughout the area. After a long period of erosion of the uplifted Grenville orogenic belt, flat-lying Ordovician Black River limestone was laid down on the peneplained Grenville surface, some 460 to 480 million years ago. A small remnant outlier of this Ordovician limestone occurs in the southwest part of Cavendish Township.

Structural Geology: The Anstruther granitic batholith is almost completely surrounded by a conformable sequence of strongly foliated Late Precambrian rocks of the Grenville Supergroup. These metasediments separate the oval-shaped Anstruther batholith from the related Burleigh and Cheddar granitic batholiths to the south and north respectively. Structurally the Anstruther batholith is a strongly foliated, double domed body, with two apparent centres of granitic upwelling. One of these centres lies in the northwest portion of the batholith north of Bottle Lake. The other, a more distinct centre owing to the presence of a large re-entrant segment of metasediments around Rathbun Lake in south-central Anstruther Township, lies to the north of Rathbun and Serpentine Lakes. The foliation in the hybrid granite gneiss sweeps completely around and closes about these centres. The foliation in the surrounding metasediments conforms to the regional gradational contacts of the Anstruther batholith. Numerous small and several large metasedimentary relics occur well within the regional boundaries of the batholith and all are oriented parallel to its double domed gneissic structure. In general, the area is traversed by three major fracture systems: a north- to northeast-trending system, an east-northeast-trending system, and a northwest-trending system. Relative movement along these fracture systems, if any, was not discerned during this survey.

ECONOMIC GEOLOGY:

Iron: Three magnetite-rich skarn zones in a large relict marble segment in the northeast part of Anstruther Township are currently under exploration-development by Biron Bay Gold Mines Limited. The largest deposit, the C zone has a drill indicated strike length of approximately 1,000 feet (300 m) with magnetite-rich zones 25 to 130 feet (7.6 to 39.6 m) wide. Total iron content ranges from 7.9 to 28.07 percent Fe per ton (Evans 1973). Preliminary work, to date, on the smaller A and B zones have indicated only limited tonnages of magnetite-rich material.

Sulphides: Minor amounts of pyrite, chalcopyrite and pyrrhotite are associated with magnetite-rich, amphibole-garnet skarn zones such as those that occur on the Biron Bay Gold Mines Limited property.

Uranium: The two most important uranium prospects in the map-area out of a total of 24 separate documented occurrences are the Cavendish uranium deposit in Lot 14, Concession VII, Cavendish Township and the Loon Call Lake uranium deposit along the south-central boundary of Anstruther Township. The radioactive minerals, primarily uranothorite, uraninite, and allanite occur in pink to reddish coloured pegmatitic granite or granite pegmatite bodies within the metasedimentary belt adjacent to the regionally defined boundaries of the Anstruther batholith or within this or related granitic bodies near their margins.

The Loon Call Lake uranium deposit (formerly the Zenmac Metal Mines Limited occurrence) owned by Camindex Mines Limited, lies within the mixed boundary zone between the Anstruther and Burleigh batholiths. The property is primarly underlain by grey hybrid granite gneiss and granite pegmatite containing numerous screens of biotite amphibolite, biotite paragneiss, garnet biotite gneiss and the occasional silicated marble band. In one uranium-bearing pegmatite dike adjacent to an east-trending band of garnet biotite gneiss there is an estimated 406,000 tons of indicated and inferred reserves grading 1.77 pounds of U_3O_8 per ton (Northern Miner 1968a).

The Cavendish uranium deposit owned by Amalgamated Rare Earth Mines Limited, occurs in a small concordant granite body intruding the interbedded marble and paragneiss in Lots 14 and 15, Concession VII, Cavendish Township. This 3,000 foot (1000 m) long and 1,000 foot (300 m) wide lenticular body comprises a mixture of pink leucogranite, pegmatitic granite and pegmatite. Several uranium-bearing zones within this body contain allanite, uranothorite and uraninite localized in fractured and brecciated darker red coloured phases of the leucogranite, or pegmatite granite. Often present in these darker red coloured phases of the pegmatitic granite are disseminated magnetite, minor molybdenite, clots of biotite and irregular patches of smokey coloured, cataclastic quartz. Uraninite in particular, is closely associated with magnetite, and in the highest-grade sections, coarse magnetite forms discontinuous bands ½ to 1½ feet (0.2 to 0.5 m) thick. The main deposit on the property is estimated to contain a drill indicated 435,624 tons grading 0.096 percent (1.92 lbs.) U_3O_8 per ton of which 80 percent lies above the 300 foot (100 m) level measured down the flat dip (15 to 30 degrees) of the uranium-bearing zone (Northern Miner 1968b). The metasediments and the host pegmatitic body itself strike north and dip irregularly between 25 and 40 degrees to the west.

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No.23 MATTAWA-DEEP RIVER AREA

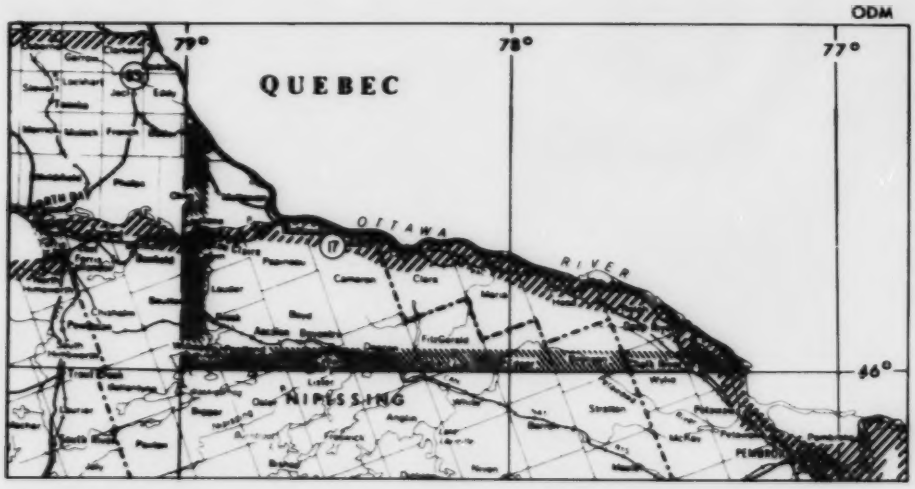
DISTRICT OF NIPISSING

AND COUNTY OF RENFREW

by

S.B. Lumbers[1]

LOCATION: The Mattawa-Deep River area covers about 2,100 square miles (5440 km^2) between Longitude 79°00'W and the Ottawa River. The southern boundary is Latitude 46°00'N. The northern part of Algonquin Provincial



LOCATION MAP Scale: 1 inch to 25 miles

Park and the Towns of Mattawa, Deep River, and Chalk River are included in the area. Most of the map-area between Longitudes 79°00'W and 78°00'W was mapped during the 1972 and 1973 field seasons (Lumbers 1972; 1973). During the 1974 field season, mapping was completed, of the entire region, at a scale of 1 inch to 1 mile, except for a few small areas of particularly complex geology.

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MINERAL EXPLORATION: Deposits of iron, titanium, vanadium, molybdenum, uranium, rare earths, magnesium, beryllium, garnet, feldspar, mica, graphite, and kyanite have been explored in the Mattawa-Deep River area, but the only production attained has been from deposits of feldspar and mica, mainly in the 1940s and 1950s. Present production is confined to sand and gravel used mainly for local construction purposes.

GENERAL GEOLOGY: The Mattawa-Deep River area is underlain mainly by rocks of the Grenville Province of the Canadian Precambrian Shield. Thin, isolated, Paleozoic outliers unconformably overlie the Precambrian rocks near some major faults of the Ottawa-Bonnechère Graben that extends westerly across the central and southern parts of the area (Lumbers 1972; 1973).

Major features of the general geology of the Mattawa-Deep River area west of Longitude 78°00'W were described previously (Lumbers 1972; 1973). To the east of Longitude 78°00'W, about 80 percent of the rocks exposed are metasediments, and the remainder are igneous rocks, mainly members of the anorthosite suite. Rock exposure in this eastern portion of the area ranges from excellent to poor, with several relatively large zones of essentially no outcrop due to an extensive cover of Quaternary deposits. These covered zones are in northern and central Head, northeastern Rolph, much of Buchanan, western and central Wylie, and south of the Petawawa River in Bronson and Edgar Townships; they present considerable difficulty in tracing bedrock units.

The metasediments are the oldest rocks exposed and are mainly coarsely recrystallized derivatives of moderately to well sorted sandstones containing numerous intercalated units of shale, siltstone, and calcareous sandstone. Most of the metasandstones contain a relatively high proportion of potassic feldspar, and although thin units derived from arkose and subarkose are widespread, the majority of the metasandstones contain at least 10 percent biotite and minor epidote and amphibole indicative of some original clay and carbonate impurities. Thin marble units are intercalated with these clastic metasediments in a few places in northern Rolph Township, and along the Ottawa River in Buchanan Township.

Except for a few early sills and dikes of amphibolite present here and there in the metasediments, rocks of the anorthosite suite are among the oldest intrusive rocks found in the eastern portion of the Mattawa-Deep River area. Seven major intrusions are present: one in western Edgar and southern Maria Townships; one extending northward from the Petawawa River in north-central Bronson Township into central Head Township; two intrusions in northern Head Township near Ottawa River; one in northeastern Rolph Township; one extending northward from southeastern Wylie Township into southeastern Rolph Township; and one in eastern Buchanan Township near Ottawa River. Most of these bodies are complex intrusions consisting mainly of tonalite, syenite, and quartz monzonite. Anorthosite is either absent, or only a minor phase, but the intrusion in Bronson and central Head Townships consists mainly of gabbroic anorthosite. All seven intrusions are irregular in plan; they range

in size from about 1 square mile (2.6 km^2) to nearly 20 square miles (52 km^2), and some appear to be stocks, whereas others are folded sill-like bodies concordant with structures in the host metasediments. In addition to these seven major intrusions, there are several thin sills of syenitic and tonalitic rocks scattered throughout the metasediments. All of the anorthosite suite intrusions are regionally metamorphosed and their rocks are mainly gneissic, but local massive phases with primary igneous textures are present. Contacts of the sill-like intrusions are commonly marked by narrow zones of graphitic schists which grade over a few feet into the gneissic intrusive rocks. Three stocks of gneissic quartz monzonite are present in Bronson and western Wylie Townships near Petawawa River. These stocks are all elliptical in plan and range in size from about 2 to 12 square miles (5 to 31 km^2). Petrogenetic and age relationships between these stocks and the anorthosite suite intrusions are presently unknown.

The metasediments and intrusive rocks described above were subjected to an intense, Late Precambrian dynamic metamorphism that caused them to be coarsely recrystallized and deformed into gneisses. Mineral assemblages developed in the various gneisses are mostly typical of the middle to upper almandine-amphibolite facies. Migmatitic phases are common in most of the metasediments and intrusive rocks containing potassic feldspar, especially where these rocks are intensely sheared. When the metamorphism was on the wane, granite pegmatite dikes were emplaced throughout the metasediments and intrusive rocks, and following this event, diabase and lamprophyre dikes, some of which may be Phanerozoic in age, were emplaced along fault zones of the Ottawa-Bonnechère Graben (Lumbers 1972; 1973). Most of these dikes are spacially associated with the Mattawa River Fault (see below) and faults along and nearby the Petawawa River. Some of the dikes are mylonitized, whereas others are massive and undeformed indicating a variation in age of dike emplacement relative to the faulting.

Structural Geology: The gneissic metasediments and most of the intrusive rocks are complexly folded with relatively tight, recumbent folds predominating. For the most part, foliation surfaces dip east to northeast at angles less than 40 degrees, but near the largest intrusive stocks, complex dome and basin structures dominate the metasediments. Both large and small scale structures in the metasediments suggest that these rocks were subjected to polyphase deformation which culminated during the Late Precambrian metamorphism. Broad open folds and gentle flexures are superimposed on the main structural fabric of the gneisses and are related to the postmetamorphic uplift and cooling history of the area.

Several major, west- to northwest-trending faults related to the Ottawa-Bonnechère Graben are present in the eastern half of the Mattawa-Deep River area. The Mattawa River Fault, a westerly trending structure marking the northern margin of the Ottawa-Bonnechère Graben in the western half of the area (Lumbers 1972; 1973) was traced along Ottawa River to the eastern boundary of the map-area. This fault is marked by prominent zones of mylonitization,

cataclasis, brecciation, and hematitization up to nearly ½ mile (0.8 km) wide, and on the northern side of Ottawa River at Des Joachims, it is straddled by the spillway dam of the Hydro Electric Power Commission. Locally, small zones of fenitization and carbonate veins are found along some of the faults, but carbonatite-alkalic rock complexes such as those present along the graben to the west (Lumbers 1973) appear to be absent.

ECONOMIC GEOLOGY: Very little exploration work appears to have been carried out in the eastern half of the Mattawa-Deep River area. A few granite pegmatite dikes have been explored for feldspar and mica, and minor concentrations of iron-titanium oxide minerals were discovered, by the writer, near the margins of sill-like, anorthosite suite intrusions in Buchanan and northern Rolph Townships. Concentrations of graphite were discovered, by the writer, locally at the margins of some anorthosite suite intrusions and in late shear zones within these intrusions. During the 1974 field season, additional work by the writer in the western half of the Mattawa-Deep River area revealed a few partly recrystallized intrusions of mafic to ultramafic rocks in Mattawan Township. These bodies are generally less than ½ mile (0.8 km) across, but locally, they contain as much as 10 to 15 percent disseminated iron-titanium oxide minerals and rare pyrite and chalcopyrite in a host rich in garnet, olivine, and recrystallized pyroxene.

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Geophysics/ Geochemistry Section

GEOPHYSICAL AND GEOCHEMICAL SECTION SURVEYS, 1974

by

K.D. Card[1]

During the summer of 1974 the Geophysics-Geochemistry Section had two geophysical projects and three geochemical projects in the field.

A relative, vertical field, ground magnetic survey was carried out by R.B. Barlow in the Squaw, Vista, and Vanessa Lakes area, District of Thunder Bay as part of an ongoing project designed to improve geological-geophysical interpretation and correlation in metavolcanic belts.

A gravity survey over part of the Sturgeon Lake metavolcanic belt, Districts of Kenora and Thunder Bay, was carried out by Barlow, Wadge, and Dusanowskyj to outline the deeper geological and structural characteristics of the belt, and also to improve the detail of the gravity station network in Ontario.

The initial phase of a joint project between the Geophysics/Geochemistry Section and the firm of Paterson, Grant and Watson Limited to compare magnetic susceptibility maps, derived from aeromagnetic maps, with local geology was completed. The results from a test area in northern Ontario indicate that further work is warranted.

The section staff are making an ongoing effort to acquire and create computer programs in order to set up a computer library integrated with sufficient computer hardware to rapidly interpret large amounts of geophysical and geochemical data.

In integrated exploration the Geochemistry-Quaternary geology survey by L.G. Closs and E.V. Sado in the Beardmore area investigated metal dispersion in areas blanketed by glacial sediments and applied the results to the problem of detecting unexposed mineral deposits in continentally glaciated terrain of the Precambrian Shield. A similar project involving overburden and vegetation sampling over parts of the Prairie Lake carbonatite complex and Killala Lake alkalic complex was also carried out by Closs and Sado.

An initial orientation survey involving lake water and sediment sampling for uranium and base metals was carried out by Closs in the Elliot Lake area.

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Stream sediment samples were collected on the Slate Islands by R.P. Sage (Geologist, Precambrian Geology Section) during the course of geological mapping; the project is discussed in Article No. 12 in the Precambrian Geology Section of this report. These samples are to be analyzed as part of the program to assess the mineral potential of the islands.

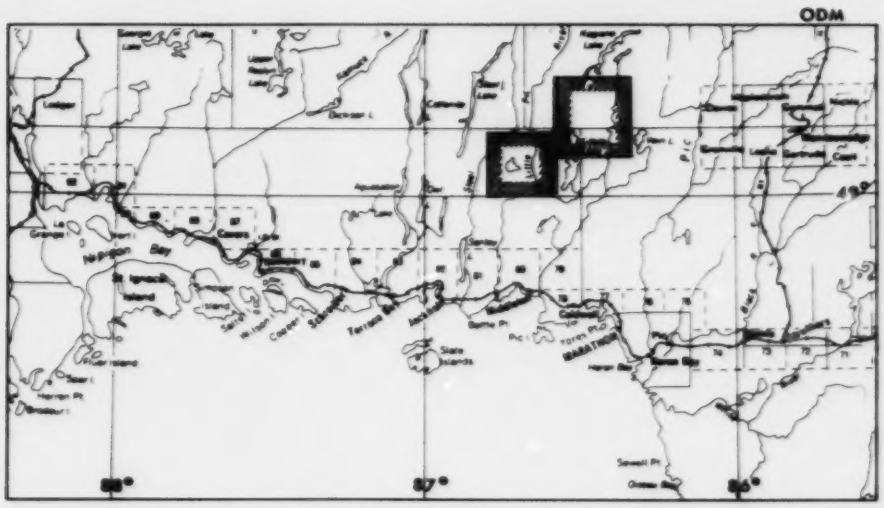
Volcanic rocks from Ben Nevis Township in the Abitibi Belt are being analyzed as part of a program by L.S. Jensen (Geologist, Precambrian Geology Section) to examine bedrock geochemistry of volcanic belts.

No.24 ORIENTATION EXPLORATION GEOCHEMISTRY AND QUATERNARY GEOLOGY INVESTIGATIONS OF CARBONATITE-ALKALIC COMPLEXES AT PRAIRIE LAKE AND KILLALA LAKE DISTRICT OF THUNDER BAY

by

L.G. Closs[1] and E.V. Sado[2]

INTRODUCTION: Carbonatite-alkalic complexes are potential hosts for niobium (columbium) and tantalum, rare earth elements of the cesium subgroup, and thorium ores (de Kun 1962; and Heinrich 1966). Economic concentrations



LOCATION MAP Scale: 1 inch to 25 miles

of iron, titanium, manganese, copper, apatite, barite, fluorite, vermiculite, nepheline, and carbonate rock may be associated with these rock types and zirconium and strontium may prove to be by-products. The initial recognition

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and mineral assessment of these complexes was largely the result of the extensive search for radioactive mineralization (principally uranium) conducted during the period 1950 to 1956. Previous work on carbonatite-alkalic complexes by the Geological Branch is summarized by Parsons (1961), Satterly (1957) and Ferguson (1971). Recently the Branch has initiated a detailed program to assess the geology and metal resources of the carbonatite-alkalic rocks in the Province. The geochemical investigations outlined here constitute a supportive and complimentary phase of the larger, bedrock-mapping project being undertaken by R.P. Sage (1974) of the Precambrian Geology Section.

Circular to elliptical high intensity aeromagnetic anomalies are characteristic of carbonatite-alkalic complexes and their presence has been inferred on this basis (Ferguson 1971). Many localities in northern Ontario characterized by such patterns are largely covered by overburden and hence bedrock geology evaluation is severely restricted. Elsewhere, in geologically favourable terrains such as the Kapuskasing Structural Zone, regional magnetics may mask the more subtle local magnetic reflections of intrusive centres. Considering the diagnostic chemistry of these rock types, orientation geochemical investigations, consisting of shallow overburden and vegetation sampling and infrared air photographic surveys, were initiated in two areas where preliminary bedrock mapping had been completed and more detailed work is to be conducted by R.P. Sage. The objectives of the project are 1) to investigate metal dispersion in Quaternary deposits overlying the complexes, 2) to investigate metal dispersion in trees rooted in this material, 3) to compare these results with those of the bedrock mapping and geochemical studies by R.P. Sage, 4) to evaluate the effectiveness of the infrared air photographic surveys as a means of portraying the documented ground conditions, and 5) to make recommendations for the optimum procedures to follow in the regional and detailed geological evaluation of carbonatite-alkalic complexes elsewhere in the Province. The two areas sampled were the carbonatite complex at Prairie Lake (Watkinson 1974, Personal Communication) and the alkalic complex at Killala Lake (Coates 1970) located, respectively, 25 miles (40 km) north-northwest and 30 miles (48 km) north of Marathon, District of Thunder Bay. Access was via float-equipped aircraft from Pays Plat on Lake Superior.

GEOLOGY: The Prairie Lake carbonatite, approximately 1 square mile (2.6 km^2) in area, intrudes felsic plutonic rocks of Early Precambrian (Archean) age. Watkinson (1974, Personal Communication) showed that within the carbonatite rocks, narrow bands of biotitite and ijolite are found concentrically distributed in the outer portions of the intrusion whereas the core is comprised of urtite and ijolite. Exploration work has been concentrated on the southwest margin of the complex and has consisted of geochemical soil sampling, ground magnetic and radiometric surveys, pitting and trenching, and diamond drilling (Assessment Files Research Office, Ontario Division of Mines, Toronto; and Newmont Mining Corporation of Canada Limited, Personal Communications). Regionally, Zoltai (1965; 1967) indicated that the bedrock of the area is predominantly overlain by deltaic sand and valley train deposits. Locally the intrusion, which constitutes a topographic high, is surrounded on three sides (Prairie

Lake being on the south) by sand flats and muskeg. On the hill itself an ablation till covers areas of deeper overburden whereas an immature residual soil has developed from the weathering of shallowly buried bedrock. Clasts of local rock types are found near the base of the ablation till and suggest a possible mixing of ablation and basal till facies.

The Killala Lake alkalic complex is situated northeast of Killala Lake, covers an area of roughly 30 square miles (78 km^2) and intrudes Early Precambrian (Archean) migmatites and granitic gneisses. The geology has been described by Coates (1970). The core of the complex consists of syenitic rocks intruded by olivine nepheline syenite and minor nepheline syenite pegmatite dikes. The outer or 'Rim' syenites are undersaturated and nepheline bearing. Gabbroic rocks occupy the margins of the complex on the east, south, and west. Copper-nickel mineralization is associated with an olivine-rich phase of the peripheral gabbros and niobium mineralization occurs as pyrochlore within nepheline syenite pegmatites in the central part of the complex. Zoltai (1965; 1967) indicated that most of the intrusion is overlain by silty to sandy till with lacustrine sand and varved or massive clay and silt flanking the complex on the south and east.

Within the sampled areas, the overburden is predominantly ablation till. Immature residual soils have developed in areas of steep slopes and bedrock at shallow depths. Between the ridges of gabbroic rocks and southwest of the margin of the complex the overburden is a sandy material related to the discharge channel from Sandspit Lake south to Killala Lake.

GEOCHEMICAL SAMPLING AND ANALYSIS: Reconnaissance overburden sampling of the entire Prairie Lake carbonatite consisted of the collection of 'B' horizon soils and till material on a 1,000 foot (305 m) square grid oriented N45E and N45W, parallel and perpendicular, respectively, to the regional glacial ice transport direction (Zoltai 1965; 1967). Intermediate-scale sampling comprised collection of the same materials at sites located 250 feet (76.2 m) apart northeast-southwest and along reconnaissance grid lines 1,000 feet (304.8 m) apart. This block, measuring 2,000 feet (609.6 m) by 3,000 feet (914.4 m) in the down-ice direction, covered a sector on the southwest flank of the carbonatite in which all rock units known to exist in the complex were represented and where the majority of the exploration work had been concentrated. Detailed sampling was undertaken over one of the most economically interesting parts of the intermediate block. Sites were located at 100 foot (30.5 m) intervals along three lines which were 1,000 feet (304.8 m) long in the ice transport direction and spaced 250 feet (76 m) apart. Sites were located by pace and compass traverses tied to prominent landmarks on 1 inch to ¼ mile (1:15,840) air photographs and to an exploration grid established by the Newmont Mining Corporation of Canada Limited in 1968. A number of sites were sampled in duplicate to determine sampling variability. A total of 130 'B' horizon soil and till samples were collected from the Prairie Lake area.

At Killala Lake a block measuring 5,000 feet (1,524 m) northwest-southeast and 7,000 feet (2,133 m) northeast-southwest, situated on the southwest flank of the intrusion, and containing three of the four major lithologic members of the complex and one of two known zones of copper-nickel mineralization was selected for reconnaissance sampling at 1,000 foot (304.8 m) centred sites. Detailed sampling was conducted at 200 foot (61.0 m) spacings down-ice on lines 250 feet (76.2 m) apart. In this instance, the detailed sampling was confined to (1) the contact between olivine nepheline syenite (the fourth major rock type) and the 'Central' syenites exposed south of Kentron Lake in the interior of the complex where niobium mineralization has been reported (Coates 1970) and (2) across the peripheral gabbros within the reconnaissance sampling block where copper-nickel mineralization is known to be associated with the olivine gabbros. Sites were located in the manner described above and duplicate samples were taken at several sites as at Prairie Lake. A total of 124 'B' horizon soils and till samples were collected from the Killala Lake area.

Biogeochemical sampling at each complex consisted of sampling lower bark, second year twigs and second year needles from white (Picea glauca) or black spruce (Picea mariana) and lower bark and twigs from white birch (Betula papyrifera) at locations coincident with reconnaissance overburden sampling (1,000 foot (304.8 m) spacing) along two northeast-trending lines crossing the complex or sector of it. The presence of white or black spruce at a site was a function of local terrain conditions whereas white birch was ubiquitous. Organic and 'B' horizon soils were sampled at the base of each tree. Eighteen sites were sampled at Prairie Lake and twenty sites were sampled at Killala Lake.

All sampled material was shipped to the Mineral Research Branch Laboratory, Ontario Division of Mines, Toronto for sample preparation and chemical analysis. Soil and till samples were oven-dried at 80°C. Tills were passed through a series of stainless-steel Tyler sieves containing 16, 60 and 250 mesh screens whereas the 'B' horizon soil samples were only passed through an 80 mesh screen. The ashed material from the -16 + 60 mesh fraction of organic 'A' horizon soil samples, the -80 mesh 'B' horizon soils, the heavy mineral separate (using tetrabromethane, specific gravity 2.96) of the -60 + 250 mesh fraction of till, and the -250 mesh fraction of the till were analyzed for hot HNO_3-HCl extractable Cu, Zn, Pb, Ni, Co, Mn, and Cr by atomic absorption spectrophotometry; for Ba, Sr, Nb, La, Y, Zr, and TiO_2 by emission spectrography; and for molybdenum and phosphorus by colorimetric-gravimetric procedures. Biogeochemical sample material was dried and ashed following the procedure outlined by Wolfe (1974) and these samples were analyzed for the same suite of elements enumerated above. Samples were air dried in the field; however, the bulk of the sample preparation and the chemical analysis were undertaken by the staff of the Mineral Research Branch Laboratory, Toronto.

REMOTE SENSING: During weathering of carbonatite-alkalic rock suites a proportionally greater amount of nutrient elements, such as potassium and phosphorus, will be incorporated into the soil and vegetation overlying these units when compared to identical materials formed over host granitic rocks which have lower abundances of these metals. The increased availability of these elements may be reflected in more luxuriant growth of common forest species and/or the growth of a distinctive vegetative assemblage over the alkalic intrusions. This feature would be expressed in the chlorophyll level of the foliage. Infrared aerial photography is a remote sensing technique ideally suited for the detection of such patterns (Brooks 1972) and therefore an experimental survey was initiated to evaluate the usefulness of this technique (1) in delineating carbonatite-alkalic complexes on a regional scale and (2) in assisting geological mapping within the complexes on a more detailed scale. The survey was commissioned by the Geological Branch, Ontario Division of Mines and, under close co-operation with this branch, was designed and executed by the Ontario Centre for Remote Sensing, Surveys and Mapping Branch, Division of Lands, under the supervision of V. Zsilinszky[1].

Two flights were completed in this project; one at the end of June when the vegetation foliage was in complete but fresh condition and a second during September when the foliage enhances physiological conditions not apparent earlier in the growing season. A 2 square mile (5.2 km^2) block at Prairie Lake was initially flown at 3,000 (914 m), 5,000 (1524 m) and 8,000 foot (2,438 m) altitudes to evaluate this parameter whereas the second flight in September was flown at an altitude of 5,300 feet (1,615 m) resulting in 24 line miles (38.6 km) being photographed in total. At Killala Lake a 25 square mile (65 km^2) block was flown at an altitude of 8,000 feet (2,438 m) on the first occasion and 5,300 feet (1,615 km) on the second resulting in 60 line miles (97 km) of coverage.

The photographic specifications of the missions were as follows:

(1) Aerial Photography: 35 mm S.A.P. (Supplementary Aerial Photograph)

(2) Camera System: Two Nikon F250 Motor Drive

(3) Lenses: 24 mm and 105 mm

(4) Film: Aerochrome Infrared 3443

(5) Filters: Nikon Y48 plus CC10M

(6) Camera Position: Transverse

(7) Forward Overlap: 80 percent

The equipment was mounted in a Ministry Turbo Beaver aircraft.

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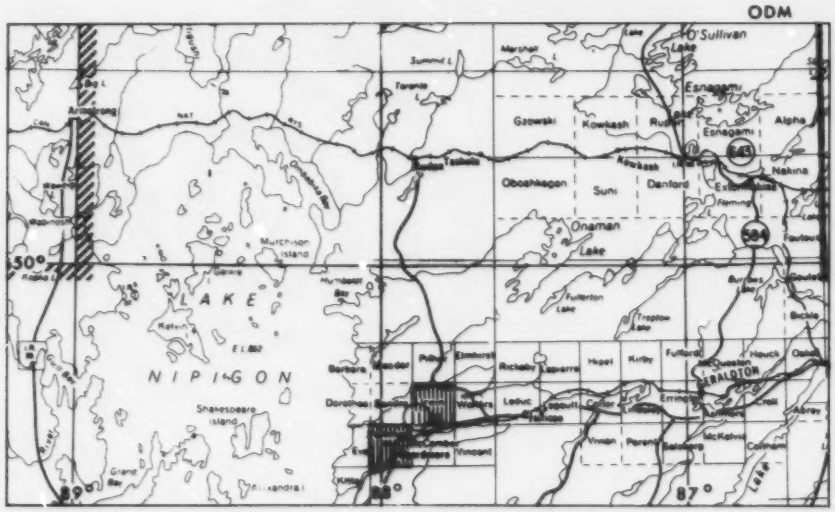
No.25 AND 30 EXPLORATION GEOCHEMISTRY AND QUATERNARY GEOLOGY RESEARCH WITHIN THE BEARDMORE-GERALDTON GOLD AREA DISTRICT OF THUNDER BAY

by

L.G. Closs[1] and E.V. Sado[2]

INTRODUCTION: There has been renewed interest in gold exploration due to the substantial price increases afforded this commodity in the past year. Prospecting within a number of geologically favourable areas in the Province is hampered by the masking effect of glacial overburden. Combined exploration geochemistry-Quaternary geology surveys were carried out in Summers and Irwin Townships within the Beardmore-Geraldton metavolcanic-



LOCATION MAP Scale: 1 inch to 25 miles

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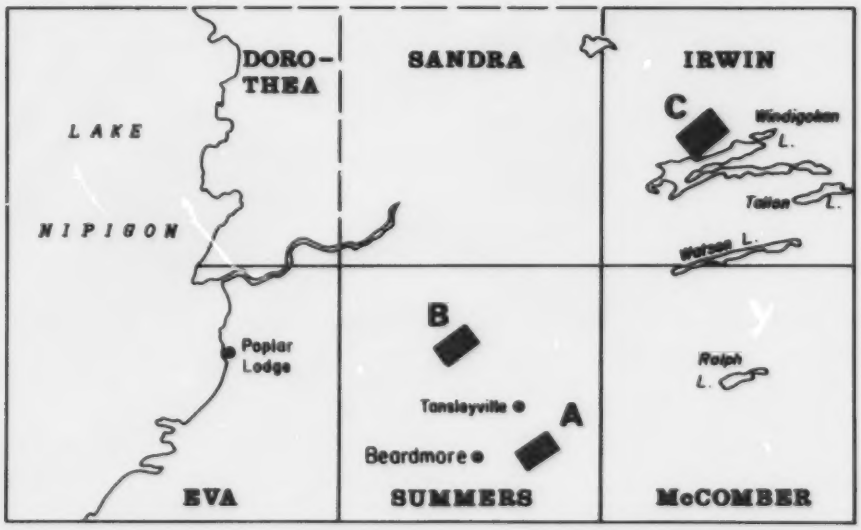
metasedimentary belt, an area of known gold mineralization. The surveys were designed to investigate metal dispersion in Quaternary deposits overlying and in a down-ice direction from known gold mineralization to establish optimum sampling and analytical techniques required to detect this type of deposit. This method may have application in gold exploration work in similarly glaciated terrain elsewhere.

The Beardmore-Geraldton belt is situated some 120 miles (193 km) northeast of Thunder Bay. Summers and Irwin Townships are located in the western half of this belt, about 40 miles (64 km) west of Geraldton on Highway 11 (see Location Map). The regional bedrock geology has been synthesized by Horwood (1948), Pye et al. (1966), and Mackasey (1970a). Geologically, the area is situated along the boundary between the Wabigoon and Quetico subprovinces of the Superior Province (Mackasey et al. 1974) and is dominated by Early Precambrian (Archean) metavolcanics and metasediments that are isoclinally folded along east-striking axial planes. The metavolcanic-metasedimentary belt extends over a distance of at least 60 miles (97 km) and is flanked on the north and south by large felsic batholiths. Smaller lenticular mafic intrusions occur within the centre of the belt. Metamorphic grade within the metavolcanic-metasedimentary succession is generally of greenschist facies.

In the past, there have been a number of producing gold mines in the Beardmore-Geraldton metavolcanic-metasedimentary belt, including Hard Rock Gold Mines Limited, MacLeod-Cockshutt Gold Mines Limited, Little Long Lac Mines Limited, Sturgeon River Gold Mines Limited, the Northern Empire Mines Company Limited, and Leitch Gold Mines Limited. The MacLeod Mosher Gold Mines Limited near Geraldton was the last producer, having closed in 1972. With the increased price of gold, many properties in this camp are currently being re-evaluated. In addition, occurrences of base metals associated with felsic volcanics, iron in the form of both oxide- and sulphide-facies iron formation, copper-nickel sulphides associated with gabbroic rocks, and molybdenite associated with quartz veins in a granitic intrusion are present within the area (Mackasey 1970a) and are or have recently been undergoing evaluation.

The surficial geology of the area has been described by Zoltai (1965a; 1965b; 1967). The region is predominantly covered by ground moraine consisting of silty to sandy till, with minor lacustrine deposits of varved or massive clay and silt, and sand. Glacial straie, long axes of eskers, drumlinoid ridges, and glacial fluting patterns indicate an ice advance direction to the southwest. Local variations in these regional trends have been recorded by Zoltai (1965a, 1965b; 1967). Deltaic sand and valley train deposits occupy valleys of the Sturgeon River (Namewaminikan River) and Blackwater River drainage systems, following a general west to west-southwest direction.

EXPLORATION GEOCHEMISTRY-QUATERNARY GEOLOGY: Area selection was based upon bedrock, economic and surficial geology criteria, with the latter being given most weight in order to meet the objectives of the research project. Initially, in consultation with W.O. Mackasey[1], a number of sites representing various mineralization-host rock types were considered as potential sampling locations. Air photographic interpretation of these areas provided preliminary evaluation of the surficial geology and those localities believed to be overlain predominantly by till were given priority. Before beginning overburden sampling, each area was subjected to reconnaissance Quaternary mapping to confirm air photographic interpretation and to provide additional information regarding local geological conditions. On this basis, three areas were selected for investigation: the Northern Empire (A), Archie Lake (B) and Knox Lake (C) grids. Both the Northern Empire and Archie Lake areas are characterized by mineralization within structural discontinuities in mafic metavolcanics whereas in the Knox Lake area mineralization occurs within a carbonate-bearing shear zone at the contact between mafic metavolcanics on the south and clastic metasediments on the north (Mackasey 1970b; 1971; 1974).



AREAS OF INVESTIGATION Scale: 1 inch to 4 miles

A southwest regional ice-flow direction was assumed. At each locality, upper 'B' horizon soils and glacial material were collected from an area measuring 3,000 feet (914 m) by 5,000 feet (1524 m) in the down-ice direction. Furthermore, at Knox Lake the grid was extended at the southwest corner to include an area south of additional showings known in that area. Organic 'A' horizon soil samples were collected at each site throughout this grid.

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Each grid was established so that the known mineral occurrences fell approximately 500 feet (152 m) within the north boundary. Down-ice from mineralization for over 2,000 feet (610 m), sites were spaced 500 feet (152 m) apart northwest-southeast and 250 feet (76 m) apart northeast-southwest. Elsewhere on the grids, samples were collected at intervals of 1,000 feet (305 m) northwest-southeast and 500 feet (152 m) parallel to the ice movement direction. Sites were located by pace and compass traverses tied to prominent landmarks on 1 inch to ¼ mile (1:15,840) air photographs. One site in ten was sampled in duplicate to determine sampling variability. Three hundred and fifteen 'B' horizon soil and till samples and one hundred and fifteen organic 'A' horizon soil samples were collected from the three areas under investigation. A limited number of grab samples of bedrock and mineralizationization were obtained from each mineral occurrence.

All sampled material was submitted to the Mineral Research Branch Laboratory, Ontario Division of Mines, Toronto for sample preparation and chemical analysis. Soil and till samples were oven-dried at 80°C. Tills were passed through a series of stainless-steel Tyler sieves containing 16, 60 and 250 mesh screens whereas the 'B' horizon soil samples were only passed through an 80 mesh screen. The ashed material from the -16 + 60 mesh fraction of organic 'A' horizon soil samples, the -80 mesh 'B' horizon soils, the heavy mineral separate (using tetrabromethane, specific gravity 2.96) of the -60 + 250 mesh fraction of till, and the -250 mesh fraction of the till were submitted for chemical analysis. Hot HNO_3-HCl extractable Ag, As, Cu, Cr, Zn, and Pb were determined by atomic absorption spectrophotometry; Sn, B and Zr were determined by emission spectrograph; and Au (where at least a 5 g quantity of sample was available) was estimated by a combined fire assay concentration - atomic absorption estimation procedure (Wolfe 1972).

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No.26 GEOCHEMICAL ORIENTATION SURVEY IN THE ELLIOT LAKE AREA DISTRICT OF ALGOMA

by

L.G. Closs[1]

During the first week of September 1974 a helicoper-supported orientation survey involving the collection of lake waters and lake sediment samples from 45 sites was conducted in the Elliot Lake area. Material was collected from lakes situated near several radioactive geological units (the Matinenda and Lorrain Formations) and from background regions remote from mineralization. The -80 mesh fractions of the lakes sediment samples were submitted for determination of U, Sc, Y, Pb, Fe, Mn, As, Ag, Cu, Ni, Zn, and L.O.I. (loss on ignition). The lake waters were analyzed for U, Pb, Fe, Mn, As, Ag, Cu, Ni, and Zn. All analytical work was done by the Mineral Research Branch Laboratory, Toronto.

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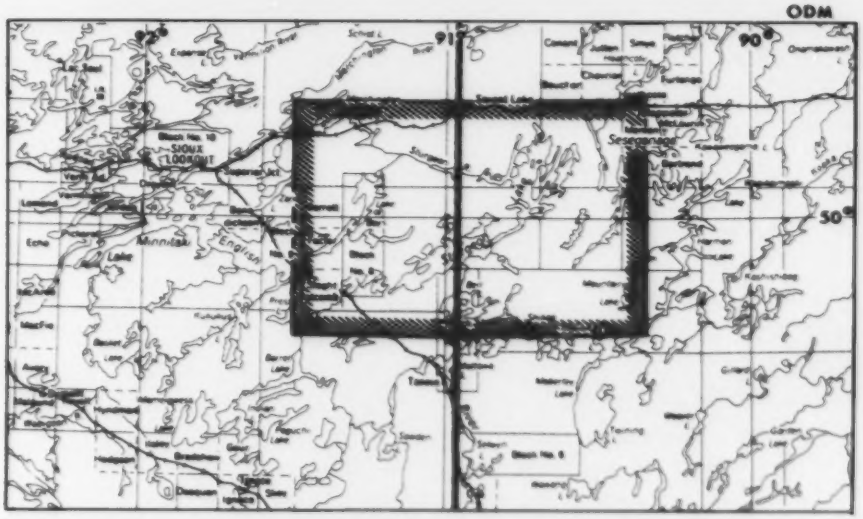
No.27 A GRAVITY SURVEY OF THE STURGEON LAKE METAVOLCANIC-METASEDIMENTARY BELT DISTRICTS OF KENORA AND THUNDER BAY

by

R.B. Barlow[1]

LOCATION: The survey area is bounded by Latitudes 49°45' and 50°15'N, and Longitudes 90°21' and 91°30'W, covering an area of approximately 1,800 square miles (4600 km^2). The central part of the area is approximately 48



LOCATION MAP Scale: 1 inch to 25 miles

miles (77 km) east-southeast of Sioux Lookout and 52 miles (84 km) northeast of Ignace. General access to the region is provided by Highways 599 and 642. Mining and lumbering roads provide additional access to lakes which are, in some cases, interconnected by portages. Remote areas may be reached by charter aircraft departing from the north end of Sturgeon Lake, Ignace and Sioux Lookout.

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GRAVITY SURVEY: A total of 1,274 new gravity stations were established between June 1st and September 1, 1974, with an average distribution of one station per 1.41 square miles (3.65 km^2). This spacing provided a large areal coverage with sufficient detail to allow interpretation of the larger upper crustal, geological features in the area.

The gravity survey was tied to the National Gravity Network by occupying previously established control stations at Ignace and Sioux Lookout. Ten local base stations were established in the survey area. All readings are being reduced according to the methods and standards of the Gravity Division, Department of Energy, Mines and Resources, Canada (Buck and Tanner 1972).

Horizontal control was maintained by locating the stations on air photographs at a scale of 1 inch to ¼ mile (1:15,840) and then transferring their positions to a base map at a scale of 1 inch to 1 mile (1:63,360). The base map was assembled in a Modified Transverse Mercator projection with the Ontario 3-degree co-ordinate grid superimposed. Conversion to the geographic co-ordinate system was accomplished with the aid of a computer program based on formulae taken from Colvocoresses (1965).

Vertical control was mainly provided by lake levels, the elevations of which were established by standard levelling and altimeter techniques. Gravity station elevations were recorded as secondary elevations relative to the lake levels.

Morning and evening gravity base stations control readings provided a check of the meter drifts. The two Lacoste-Romberg gravity meters had a maximum daily closure error of 0.1 mgals, and averaged about 0.03 mgals. Daily theoretical tide corrections were computed for the summer survey period at 10 minute intervals, and provided a means of checking daily survey performance.

In order to interpret the sources of the Bouguer anomalies, mean density values will be assigned to the major geological formations. During the survey, 1,100 rock specimens were collected and the bulk specific gravities were determined using an Ohaus triple beam balance.

Both standard and Turbo-Beaver aircraft were used for transportation during the survey period. The two crews employed on the survey completed an average of 14 stations per day over the entire season. During normal working conditions the crews completed an average of 30 stations per day.

Despite the periodic non-availability of aircraft during the course of the summer, because of the forest fire situation in northwestern Ontario, the original specifications of the survey were met. The distribution of lakes allowed an adequate distribution of station locations in the area. The gravity measurements should give interesting information which will allow the tectonic style of the metavolcanic-metasedimentary belt to be interpreted on a regional basis.

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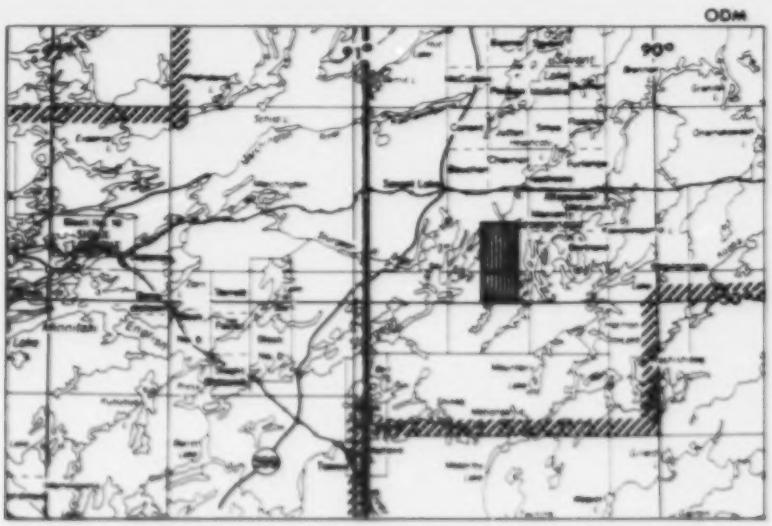
No.28 A MAGNETIC SURVEY OF THE NORTHERN PART OF THE STURGEON LAKE AREA (EAST PART) DISTRICT OF THUNDER BAY

by

R.B. Barlow[1]

LOCATION: The map-area is bounded by Latitudes 50°00' and 50°10'N and Longitudes 90°28' and 90°35'W, an area of approximately 60 square miles (155 km^2). The central part of the area is approximately 62 miles (100 km) east of Sioux Lookout and 69 miles (111 km) northeast of Ignace.



LOCATION MAP Scale: 1 inch to 25 miles

General access to the northern part of Sturgeon Lake is provided by Highway 599 and various public and private water-access points adjoining Highway 599. The localities within the survey-area are accessible by canoe through the Vista Lake-Squaw Lake waterway which empties into the Northeast Arm of Sturgeon Lake. The more remote areas can be reached by float equipped aircraft based at the north end of Sturgeon Lake, Sioux Lookout and Ignace.

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MAGNETIC SURVEY: Magnetic surveys covering 3 square miles filed by two companies with the Ontario Ministry of Natural Resources for assessment work credit were utilized in constructing a relative, vertical field, ground magnetic map. Areas not previously covered by company grids were traversed with a Sharpe MF-1 and a Scintrex MF-2 magnetometer (both fluxgate) at line intervals of 800 feet (243.8 m) with station spacings of 100 feet (304.8 m). On land, chain-and-compass techniques were used throughout the survey and air photographs at a scale of 1 inch to 800 feet (1:9600) provided traverse location control. Traverses across lakes were made by canoe and were controlled using standard navigational techniques. Readings taken while under constant speed were periodically timed and distributed along the traverses between known location points.

The data were compiled using a common magnetic base value established during the present field survey. The relative differences between company survey values and present values were obtained by re-occupying parts of a number of company traverses in localities having a low magnetic gradient. An arithmetic average of the differences was then applied to reduce the company magnetic survey values to a common base level. A local base level was established by having both survey magnetometers 'read in' a base station network consisting of three temporary base stations and one permanent base station at Savant Lake established by Moon (1972). Values for the temporary base stations on the Northeast Arm of Sturgeon Lake, and at Vista Lake and Vanessa Lake were 1020±10 gammas, 1040±10 gammas and 1100±10 gammas respectively, relative to the Savant Lake base station value of 1080±10 gammas.

Diurnal changes in the Earth's magnetic field were recorded to an accuracy of ±5 gammas using a McPhar M-700 (fluxgate) magnetometer and a Rustrak Model 288 recorder, powered by a 12 volt automobile battery. Continuous monitoring of diurnal variations at the temporary base stations has shown that the average summer variation, during daylight hours and excluding magnetic storm activity, was approximately 20 gammas. The magnetogram records show that this 20-gamma average peak was most prevalent around 2 p.m. daily, excluding disturbed days. Maximums of much higher intensity, generally considered to be related to abnormal activity on the sun (Chapman and Bartels 1940), were observed to be within the range of 75 to 400 gammas and were most prevalent during night-time.

Magnetic susceptibility values, which include every major rock types in the map-area, were obtained at 109 locations utilizing a Bison 3120 susceptibility meter equipped with an 'in situ' coil. This instrument enables the user to obtain a direct readout in CGS units at the sample site.

MINERAL EXPLORATION AND ECONOMIC GEOLOGY: Early exploration for gold in the Sturgeon Lake area is reported to have begun around 1898 (Moore 1911). The most important gold deposit in the region, known as the St. Anthony Mine, currently controlled by Can-Con Enterprises and Explorations Limited, was discovered soon after this period. Mining continued intermittently until 1941 with a total of 63,310 ounces of gold and 16,341 ounces of silver being recovered from 331,069 tons of rock milled (Ontario Division of Mines, Statistical Files, St. Anthony Gold Mines Limited, Northern Gold Reef Limited).

Trowell (1972) has reported that most of the gold occurrences in the map-area are found in quartz veins and porphyritic dikes that cut the mafic to intermediate metavolcanics. Chalcopyrite and pyrite are locally present in minor amounts.

The discovery of the five deposits of ore grade material (Zn-Cu-Pb-Ag-Au) originally resulted from an airborne electromagnetic-magnetic survey flown in 1969 by Mattagami Lake Mines Limited. That survey outlined zones of anomalous conductivity and magnetic intensity, some of which are related to the occurrence of the concealed mineral deposits. Further exploration by various ground-follow-up techniques and systematic diamond drilling in the area outlined the mineralized zones (see Table 1).

Table 1 **Recent Geophysical Discoveries in the Sturgeon Lake Area**

Owner	Deposit Name	Discovery Date	Deposit Type	Current Tonnage Estimate (million tons)	Average Grade					Development		Strike Length (feet)
					Zn (%)	Cu (%)	Pb (%)	Ag (oz/ton)	Au (oz/ton)	Mode	Production (tons/Day)	
Mattabi Mines Ltd.	Mattabi	September 1969	Zn-Cu-Pb-Ag-Au	12.8	7.60	0.91	0.84	3.13	0.007	Open Pit	3,000	1,800
Sturgeon Lake Mines Ltd.	Boundary	October 1970	Zn-Cu-Pb-Ag-Au	2.1	10.64	2.98	1.47	6.14	0.02	Open Pit	-	1,000
Mattagami Lake Mines Ltd.	Lyon Lake	October 1971	Zn-Cu-Pb-Ag-Au	1.1	6.81	1.03	0.59	2.96	0.007	Under-ground	-	1,400
Mattagami Lake Mines Ltd.	Creek	February 1972	Zn-Cu-Pb-Ag-Au	.9	8.84	1.66	0.76	4.71	0.019	Under-ground	-	700
Mattagami Lake Mines Ltd.	Group F	March 1970	Zn-Cu-Ag-Au	-	-	-	-	-	-	-	-	400

GEOLOGICAL COVERAGE: The geology of the Sturgeon Lake area was first described by W. McInnes of the Canadian Geological Survey in 1899 (McInnes 1902). In 1901, A.P. Coleman (1902) described early development work at the St. Anthony mine. The first geological map covering part of the survey-area, at a scale of 1 inch to ½ mile was published together with a report by E.S. Moore in 1911 (Moore 1911). A geological compilation (Sioux Lookout-Armstrong Sheet) Map 2169 was published in 1970 at a scale of 1 inch to 4 miles (Davies, Pryslak, and Pye 1970).

During the 1973 and 1974 summer field seasons, N.F. Trowell and assistants mapped the survey-area at a scale of 1 inch to ¼ mile (Trowell 1974a; 1974b).

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1973a: Squaw Lake-Sturgeon Lake Area, Northeast Arm-Sturgeon Lake Sheet, District of Thunder Bay; Ontario Div. Mines, Prelim. Map P.842, Geol. Ser., scale 1 inch to ¼ mile. Geology 1972.

1973b: Squaw Lake-Sturgeon Lake Area, District of Thunder Bay; p.33-37 in Summary of Field Work, 1973, by the Geological Branch, edited by V.G. Milne, D.F. Hewitt, and W.J. Wolfe, Ontario Div. Mines, MP56, 202p.

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No. 29 AIRBORNE MAGNETOMETER SURVEY OF THE BAMAJI-FRY LAKES METAVOLCANIC-METASEDIMENTARY BELT DISTRICT OF KENORA, PATRICIA PORTION

by

K.D. Card[1]

A high resolution airborne magnetometer survey was flown over an area in the Bamaji-Fry Lakes metavolcanic-metasedimentary belt in the fall of 1974. The area, northwest of Lake St. Joseph, is bounded by Latitudes 51°06' and 51°16'N, and Longitudes 91°16' and 91°42'W, and covers an area of 208 square miles (539 km^2).

The results of this survey will be published as soon as possible.

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Phanerozoic Geology Section

PHANEROZOIC GEOLOGY SECTION SURVEYS, 1974

by

D.F. Hewitt[1]

In 1974, there were six Quaternary geology field parties mapping southern Ontario in the Wingham, Grimsby, Hawkesbury, Barrie, Grand Bend, and Merrickville areas. One Quaternary geology sub-party was attached to the geochemical field party that worked near Beardmore and near Killala Lake, in northern Ontario. One Paleozoic geology field mapping party was working in the Fort Erie-Dunnville area.

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No.30 AND 25 EXPLORATION GEOCHEMISTRY AND QUATERNARY GEOLOGY RESEARCH WITHIN THE BEARDMORE-GERALDTON GOLD AREA DISTRICT OF THUNDER BAY

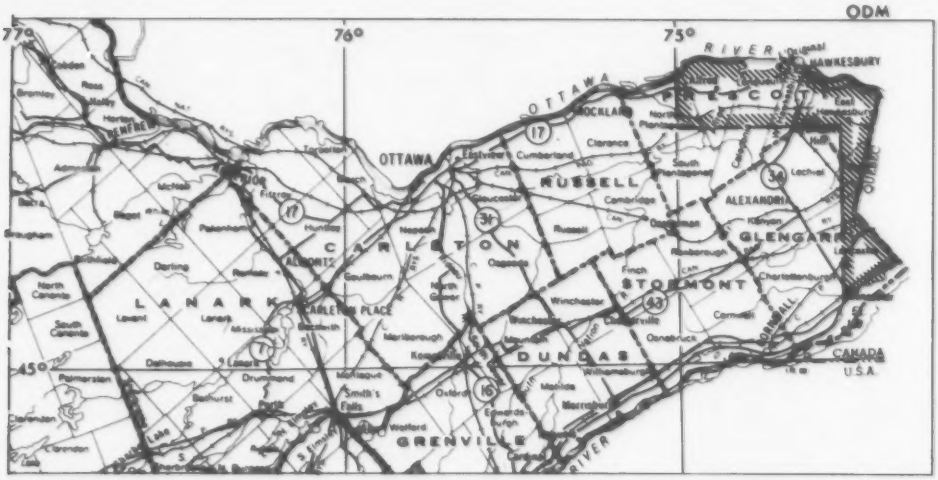
For this report, see No. 25 and 30, p. 160.

No.31 QUATERNARY GEOLOGY OF THE HAWKESBURY, HUNTINGDON, LACHUTE AND VAUDREUIL AREAS

by

Q.H.J. Gwyn[1] and J.J.L. Thibault[2]

LOCATION: The map-area is an irregularly-shaped area bounded by Ottawa River on the north and St. Lawrence River on the south and by Longitude 75°00'W on the northwest and the Quebec-Ontario border on the east



LOCATION MAP Scale: 1 inch to 25 miles

exclusive of the Alexandria and Cornwall topographic map-areas (see Location Map). It encompasses an area of 340 square miles (880 km^2). It includes National Topographic Series Maps of Hawkesbury (31 G/10), Huntingdon (31 G/1W), Lachute (31 G/9W), and Vaudreuil (31 G/8W).

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[2]Graduate Student, University of New Brunswick, Fredericton, N.B.

GEOLOGY: The bedrock is predominantly limestone and clastic sediments ranging in age from Cambrian to Middle Ordovician. A small area of Precambrian metasediments occurs in the northeastern corner of the Hawkesbury map-area. The bedrock was mapped by Wilson (1946).

Only one till unit is present in the map-area. It is compact, pebbly (10-30 percent by weight) silt to sand silt till. This is correlated with Fort Covington Till (MacClintock 1958) also mapped by Terasmae (1960) in the Cornwall map-area. It is suggested that there is only one till to be found in this part of Ontario and that a lower silt till, the Malone Till (Macclintock 1958), has possibly been defined more on the basis of highly divergent till fabric modes rather than on significant textural differences or other criteria. It is concluded from striated bedrock surfaces and their relative ages that ice flow directions shifted from southwesterly through southerly to southeasterly. The change in flow direction is further supported by the difference in the modes of till fabrics at adjacent sites. As a corollary to the presence of only one till it is suggested that the area was not deglaciated until the end of the Late Wisconsinan Substage and not subjected to late glacial lobal activity as seen in other parts of Southern Ontario.

Ice-contact stratified drift is restricted to one deposit of contorted, interbedded sand and sandy gravel immediately east of Hawkesbury. Its general absence on a regional level may indicate that the ice retreated rapidly from the area without a prolonged period of stagnation.

Following retreat of the ice the area was completely inundated by the Champlain Sea. Two types of marine sediments were mapped in the present area including clay, slightly sandy clay and silty clay, and beach deposits. Clay is more widespread and it is typically banded (alternating brownish grey and grey bands), soft sediment containing fossils of Portlandia arctica.

The beach deposits consist predominantly of bouldery to cobbley sandy gravel and are found at elevations ranging from 400 feet (122 m) to 250 feet (76 m) above sea level. The gravels are abundantly fossiliferous at 400 feet (122 m) but fossil numbers and size decrease with elevation to the extent that at 250 feet (76 m) shells are rarely found. This would indicate that there was a progressive decrease in salinity and probably an increase in temperature as the water level receded to lower elevations. Both Hiatella arctica and Macoma balthica are found throughout the range of elevations whereas Mytillus edulis, Balanus crenatus, and Balanus hameri are restricted to higher elevations (300 feet (91 m) to 400 feet (122 m) above sea level). The beach material was derived from the erosion of the underlying till by wave action.

The progressive freshening of the Champlain Sea was the result of the increased proportion of freshwater input that accompanied the gradual rebound of the land surface. Freshwater sediments were deposited in an extensive

delta (Chapman and Putnam 1966, p.48-49) as far east as Hawkesbury. The material consists of slightly silty fine to medium sand. East of Hawkesbury large sand bars were formed as at St. Eugene. Channels were developed during the deposition of the delta, some of which were refilled. Pieces of wood were found in such a channel fill immediately overlying fossiliferous marine gravels.

Upon further uplift, channels were cut into the delta and into the underlying marine sediments. Numerous slip-off terraces were formed by this process. During this period the predominant sediment deposited in the ancestral Ottawa River was silt to clayey silt, however, a few sand bars were formed as well.

Post-marine sedimentation in ancestral St. Lawrence River did not include the development of a delta. In the Huntingdon map-area it was limited to the deposition of sandy silt and silt and small patches of thin, less than 1 m (3 feet) silty sand.

Most of the present sedimentation is restricted to the Ottawa and St. Lawrence Rivers. Smaller rivers and streams are merely down cutting into older sediments as rebound continues. A notable exception to this is South Nation River, which has deposited over a metre (3 feet) of sandy silt in places and built natural levees during annual overbank flooding.

ECONOMIC GEOLOGY: Bedrock, gravel, sand, till, and peat are all excavated on a commercial basis.

Only one quarry, immediately west of L'Orignal, operates throughout the year. Here, limestone of the Ottawa Formation is crushed and used as road metal and aggregate in ready mix concrete and asphalt. Two quarries in both Alfred and East Hawkesbury Townships have been operated on a short term basis to provide aggregate for road construction, principally as cement treated base course.

Beach gravel is excavated in many small pits in both East Hawkesbury and West Hawkesbury Townships. As well, two pits have been developed in ice-contact stratified gravel in West Hawkesbury Township. In both types of deposits the gravel tends to be very coarse (cobbley to bouldery) and have a high silt content.

Approximately 10 sand pits are producing throughout the map-area. One is developed in pre-till outwash sand and the remainder in deltaic sand. The sand is used principally as fill and to a lesser extent as an aggregate.

Fort Covington Till has been excavated in many borrow pits to be used as fill in road construction. It has excellent packing properties and a high stone content.

Peat is produced at one locality from the Alfred Bog in Caledonia Township.

HAZARD LANDS: A very serious and wide-spread hazard is present in the map-area and in large parts of the Ottawa-St. Lawrence Lowlands in the form of sensitive marine clays. A sensitive clay is one which loses a large proportion of its strength once it has been disturbed (remolded). As in the Alexandria area (Gwyn and Lohse 1973, p.183), numerous small bank failures and several large earth-flows were examined.

Bank failures were found throughout the map-area and occur annually. They appear to be related to stream and river banks undergoing active erosion and range in length along the bank from a few metres to several tens of metres, the smaller ones being more common.

Of far greater hazard to property and life are earth-flows that occur in areas of locally high gradients such as along modern river courses and terraces cut by ancestral rivers. Several very large flows occurred, probably in pre-settlement times, in the vicinity of Plantagenet. The largest of these are in the order of 1 km wide and 0.75 km deep (0.6 by 0.45 mile). It is estimated that 12 million cubic metres (15.5 million cubic yards) of material was involved in each of these larger flows. Smaller slides covering an area of up to 20 hectares (50 acres) have an estimated volume of 2 million cubic metres (2.6 million cubic yards). It is disturbing to see the number of new buildings erected in potentially hazardous areas with no apparent regard for the hazard.

As well as the earth-flow hazard, the clay has a distinctly low bearing capacity. One result of this is the failure, settlement, or tilting of several new large farm silos in the map-area.

Many studies have reported on the geotechnical properties of sensitive clays but few have included a regional analyses of these properties. One such study was conducted by H. Lohse (1974) who found that a well defined bedrock valley was associated with the slides in the South Nation River area and that the clays at the earth-flow sites tended to be more leached than elsewhere. He also speculated that in this seismically active area tectonic activity could be a triggering mechanism (Lohse 1974, p.45).

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No.32 QUATERNARY GEOLOGY OF THE MERRICKVILLE AREA SOUTHERN ONTARIO

by

D.R. Sharpe[1]

LOCATION: The Merrickville map-area (NTS 31B/13) is outlined by Latitudes 44°45' and 45°N and Longitudes 75°45' and 76°W. Mapping started and was completed in 1974.

LOCATION MAP Scale: 1 inch to 25 miles

PHYSIOGRAPHY: The area forms part of the Ottawa-St. Lawrence Lowland with elevations ranging from slightly less than 275 feet to slightly more than 450

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

feet (84 m to 137 m) above sea level. The map-area can be readily divided into a bedrock controlled upland area (west), covered with thin drift, and a lower area (east), underlain by a predominance of marine sediments.

GENERAL GEOLOGY: The oldest bedrock in the area consists of several small Precambrian inliers of white quartzite which is overlapped at one outcrop by Nepean conglomerate (Cambrian?). Calcareous sandstone and sandy dolostones of the March Formation (Lower Ordovician) outcrop to a limited extent in the northwest and southeast sections of the area; the remainder of the area is underlain by thick-bedded, dark, grey, magnesian limestone of the Oxford Formation (Lower Ordovician).

These rocks have solution cavities, especially along fractures in more lime-rich areas. Wilson (1946) has previously mapped the bedrock of the Ottawa-St. Lawrence Lowland.

The glacial geology of the area is recorded in deposits representing a Late Wisconsinan glaciation. The only till sheet present in the map-area consists of greyish-brown to pale-yellow oxidized, or olive to olive-grey unoxidized till. It has a blocky, weak fissile structure and its coarse cobbley, gritty, sandy silt texture is similar to the Fort Covington Till of Terasmae (1965) and Gwyn and Lohse (1973). The position of this till, directly on bedrock, and underlying marine sediments, suggests that it is the stratigraphic equivalent of the Fort Covington Till. Glacial striae indicate that this till was deposited by ice moving initially from the northeast, while later movement, affected by the topographic high in the western part of the area, occurred from the north to northwest. No stratigraphic evidence exists, within the area, to interpret these striae as advances predating or postdating the Fort Covington advance, as Terasmae (1965) did. Some evidence exists for ice-contact stratified drift being deposited in the area northwest of Oxford Mills. No other glacial sediments were observed.

A marine invasion, known as the Champlain Sea, washed exposed bedrock and till surfaces following withdrawal of Late Wisconsinan ice. Raised beaches and wave-cut terraces at elevations from 275 feet (84 m) to 450 feet (137 m) above sea level (close to marine limit near Smith Falls) are the main features of the marine episode. Macoma balthica and Hiatella arctica are the marine fossils most commonly associated with the beach-bar sands and gravels while Mytilus edulis marks the shallow water to deeper water marine sediments. Portlandia arctica occur intermittently in deep water silty clays found in present low-lying portions of the area. Beach development is best preserved on drift mantled slopes that were exposed to persistant westerly winds; thus, the upland rocky western half of the map-area shows inferior beach development compared to the lower eastern area with drift covered knobs. In the former area the beaches are only 1 to 2 m (3 to 6 feet) high, whereas beaches in the latter area are up to 15 m (48 feet) high. The Champlain Sea existed at least from 11,800 B.P.[1] to 9,500 B.P. (Gadd 1971).

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[1]B.P. is "before present".

Post-marine activity included peat accumulation and eolian sand dune formation. Large barchan-shaped dunes up to 20 m (63 feet) high formed from redistribution of drying marine sands by west or southwesterly winds. Buried soil occurrences associated with many sand dunes mark post-settlement eolian activity. Downcutting into marine sediments, rather than alluviation in modern stream channels attests to the crustal rebound in the area.

ECONOMIC GEOLOGY: Granular resources are found solely in the beach complexes of the area. Ice-contact stratified drift is rare in the area, and wave-action on the coarse till has resulted in coarse and often incompletely washed gravel deposits. Deposits acceptable for road base and fill are present in the map-area but better quality deposits have essentially been depleted. The best remaining economic potential lies in the widespread occurrence of limestone and dolostone near the surface.

ENVIRONMENTAL GEOLOGY: Marine sediments known as "Leda clay" (see Terasmae 1965) do occur in the area; fortunately, their shallower water and hence silty, brackish water environment has resulted in a stiff, compact sediment as opposed to the "sensitive[1]" failure-prone clays to the east (see Gwyn and Lohse 1973). Solution weathering along joints in the Oxford Formation limestone leading to possible subsidence of overlying sediments is a potential concern although no evidence other than minor local features have been identified.

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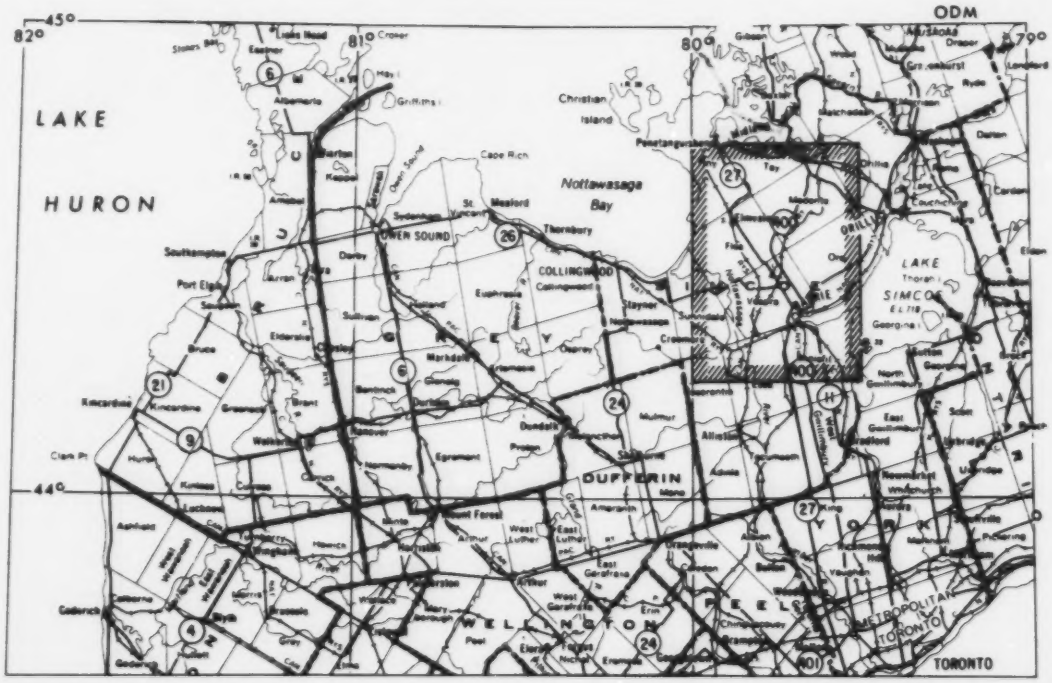
[1]"Sensitive" implies loss of strength and hence, collapse when remolding due to excess loading occurs.

No.33 QUATERNARY GEOLOGY OF THE BARRIE AND ORR LAKE AREAS SOUTHERN ONTARIO

by

G.J. Burwasser[1]

LOCATION: The Barrie map-area (NTS 31 D/5) is located between Latitude 44°15'N and 44°30'N, and Longitude 79°30'W and 80°00'W. The Orr Lake map-area (NTS 31 D/12) is bounded by the same Longitudes and extends northerly



LOCATION MAP Scale: 1 inch to 25 miles

to Latitude 44°45'N. The City of Barrie (population circa 29,000) is in the south-central part of the area at the head of Kempenfelt Bay (Lake Simcoe). Mapping of the west half of each area was completed during the summer of 1974. Land spurs extending into Georgian Bay (Nottawasaga map-area, NTS 41 A/9E) were also mapped.

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

PHYSIOGRAPHY: The map-area is divided diagonally from northwest to southeast into the Simcoe Lowlands, surrounding Nottawasaga Bay (Lake Huron), and the Simcoe Uplands, which form the core of the Penetang Peninsula. The lowlands rise from the lake level of approximately 580 feet (177 m) to the base of the Algonquin bluff at approximately 780 feet (237 m). Local relief is subdued and, with notable exceptions, does not generally rise above 25 feet (ca. 7.5 m). The Nipissing bluff from Balm Beach to Woodland Beach and west of the Minesing Swamp, the Nipissing dunes east and south of Wasaga Beach, and the valley of the Nottawasaga River downstream from Edenvale all represent sharp breaks in the topography that exceed 50 feet (ca. 15 m) in height. The Minesing "island" rises more than 100 feet (ca.30 m) above the Lowlands as does the Nipissing bluff east of the Minesing Swamp. The Lowlands are drained into Nottawasaga Bay by Nottawasaga River and into Midland Bay (Lake Huron) by the Wye River.

The Simcoe Uplands stand between 800 feet (ca. 240 m) and 1,000 feet (ca. 300 m) above sea level and are cut by several broad, flat-bottomed valleys as much as 200 feet (ca. 60 m) deep. Local relief on these uplands is generally in excess of 50 feet (ca. 15 m) and is characterized by steep plunges over the 100 feet (30 m) high shorebluffs of Lake Algonquin that surround the topographic highs. The maximum elevation in the map-area, 1,025 feet (ca. 312 m), occurs above the Algonquin bluff approximately 4.5 miles (7 km) southeast of Minesing.

GENERAL GEOLOGY: The area is underlain by carbonate rocks of Upper and Middle Ordovician age belonging to the Simcoe Group (Liberty 1969). The only bedrock exposed is sublithographic fine-grained limestone of the Gull River Formation that outcrops along Sturgeon Bay in the northeast corner of the map-area.

Quaternary deposits consist mainly of glaciolacustrine deposits, ice-contact and outwash materials, and till. The four till units within the area were deposited during or after the Port Bruce Stadial by the Lake Simcoe and Georgian Bay ice lobes. The oldest till unit is a dark grey brown, massive, very compact, slightly gritty sand till deposited from the northwest that develops a fissile fracture upon weathering and is exposed in the Nipissing bluff north of Wymbolwood Beach. The next younger till is a brown, fissile, gritty, sandy silt till, deposited back of the Nipissing bluff from slightly north of west and having a deeply fluted surface partly subdued by lacustrine reworking. Above the Algonquin bluff a brown, friable, sandy silt to sand loam till deposited from the northeast appears to be correlative to the Newmarket Till of Gwyn (1972) and may be penecontemporaneous with the fluted sandy silt till above the Nipissing bluff. The youngest till is a remobilized clay and silty clay varve sequence directly overlying the Newmarket Till and has been previously mapped as a correlative of the Kettleby Till of Gwyn (1972).

Outwash and ice-contact materials are extensive throughout the uplands in the northeast half of the Orr Lake West map-area. Compact ice-contact sand caps the "Algonquin islands" and winnowed outwash sand forms terraces between them. The south half of the Barrie West map-area is covered by outwash sand that has been reworked by Lake Algonquin below 780 feet (237 m) surface elevation.

Lacustrine gravels related to Lake Algonquin are nearly continuous along the bluff from 2.5 miles (4 km) south of Ivy to Midhurst Station in the Barrie West map-area and occur on the south (leeward) side of some of the "Algonquin islands" in the Orr Lake West map-area. Lacustrine fines occupy the lowlands below the Algonquin bluff: silt and sand in Barrie West; silt and varved clay (N.B. Kettleby Till above) in the Orr Lake West area. Eolian deposits parallel the modern shore and have buried the Nipissing bluff east of Wasaga Beach. Marl and marly clay have been deposited in the low marsh lands west of Phelpston, around Marl Lake, and southeast of Brentwood.

ECONOMIC GEOLOGY: Sand and gravel are the only mineral resources extracted within the area mapped. The coarse lacustrine deposits in Vespra, Flos, Sunnidale, Medonte, and Tiny Townships and the ice-contact sandy gravel of Medonte and Tay Townships provide much of the crushable granular material used in this part of Simcoe County. Tay, Medonte, Sunnidale, and Vespra Townships can sustain commercial operations that export gravel from the townships. Flos and Tiny Townships have sufficient resources for local use if severe demands are not made upon them in the near future. Continued development of the lacustrine gravel along the Algonquin bluff, and the ice-contact gravel south of Midland will provide the major future sources of granular material in this area.

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No.34 QUATERNARY GEOLOGY

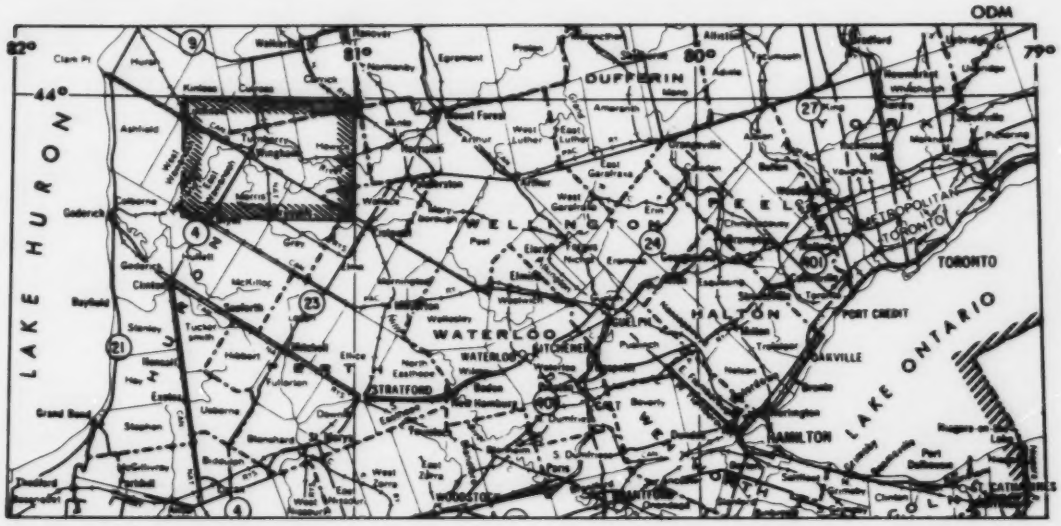
WINGHAM (40 P/14) AND LUCKNOW (40 P/13) AREAS

SOUTHERN ONTARIO

by

W.R. Cowan[1]

LOCATION: The Wingham area is bounded by Latitude 43°45' to 44°00'N and by Longitude 81°00' to 81°30'W; the Lucknow area extends westerly to Lake Huron within the same latitudinal boundaries.



LOCATION MAP

Scale: 1 inch to 25 miles

Mapping of the Wingham area was completed in 1974 and work was begun on the Lucknow Sheet.

GENERAL GEOLOGY: The area mapped is entirely underlain by Devonian carbonate rocks that outcrop along the Maitland and Teeswater Rivers, and along creeks adjacent to Lake Huron.

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

In the Wingham area the most widespread till unit is the Elma Till (Karrow 1974) which outcrops throughout the map-area, primarily at the surface. It is a stony, sandy silt till and forms the Teeswater drumlin field. It is underlain by Tavistock Till (Karrow 1974) at least as far west as Wingham. Till similar to the still older Catfish Creek Till was observed but stratigraphic evidence for this correlation is insufficient. South of the area Elma Till is overlain by silt till of the Mitchell Moraine whereas on the west it is overlain by silt till of the Wawanosh Moraine. The relationship of these latter two tills is unknown, however, they are of similar age and are physically similar. Elma Till occurs throughout the Wawanosh Moraine though the principal materials are stratified drift and the silt till mentioned above.

In the Lucknow area the primary surface till is a clayey silt till that occurs from Sharpes Creek west to Lake Huron. It is underlain by a pebbly silt to sandy silt till deposited from the northwest; correlation of this till is unknown at present. The surface till occurs in the western ridge of the Wyoming Moraine and the ground moraine west of it. The eastern ridge of the Wyoming Moraine as shown by Chapman and Putnam (1966) between Maitland River and Sharpes Creek consists of stratified drift capped by silt to sandy silt till. It is suspected that this till is older than that of the western ridge though this relationship is not proved.

The clayey silt till of the Wyoming Moraine area relates to the Port Huron Stadial whereas the remaining tills are considered, at this time, to be related to the Port Bruce Stadial.

Considerable outwash gravel occurs along the Maitland River and in an outwash plain in the vicinity of Belmore. Ice-contact stratified drift, mainly sand, occurs throughout the Wawanosh Moraine and in numerous eskers and isolated kames. Outwash sand occurs throughout the area as sheet deposits and channel fills. Lacustrine sediments occur in pondings over much of the area. To the west the Lake Warren shoreline is well worked by beach gravels and gravelly sands and the Lake Algonquin level is marked by high-level stream terrace deposits containing molluscs.

ECONOMIC GEOLOGY:

Limestone. Limestone was formerly quarried at Teeswater from the Detroit River Formation (northern facies). No quarrying is presently taking place.

Clay. Tiles were formerly produced from lacustrine silts two miles west of Belmore; the buildings from this operation remain as ruins.

Sand and Gravel. Sand and gravel pits are very numerous within the area though most operate only sporadically to produce road gravel. Small deposits are found in many places and many of the larger deposits have not been developed. The outwash deposits mentioned above represent the best possibilities for large scale commercial production though none of the deposits were sufficiently well exposed to allow evaluation of large reserves.

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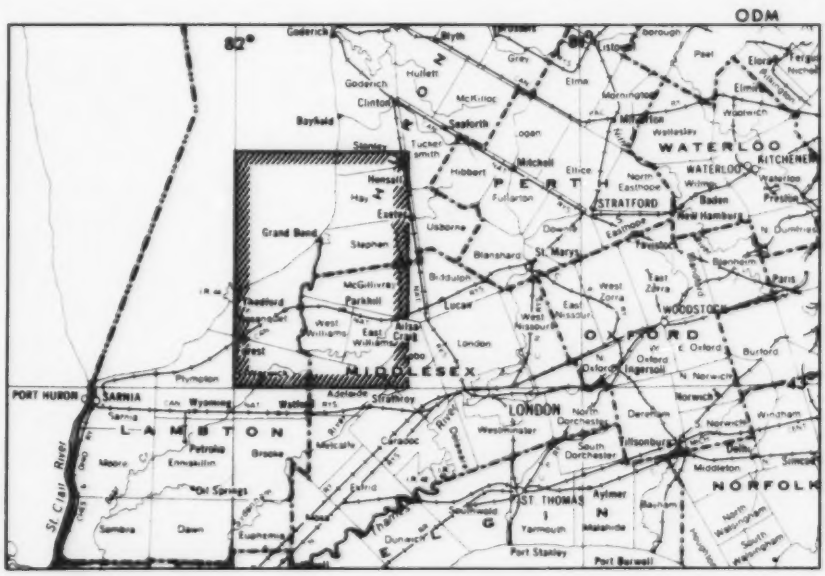
No.35 QUATERNARY GEOLOGY OF THE GRAND BEND (40 P/5) AND PARKHILL (40 P/4) AREAS SOUTHERN ONTARIO

by

A.J. Cooper[1]

LOCATION: The Grand Bend map-area is bounded by Latitude 43°15' to 43°30'N, and Longitude 81°30' to 82°00'W. The Parkhill map-area extends south to Latitude 43°00'N, and between the same lines of Longitude.



LOCATION MAP Scale: 1 inch to 25 miles

Quaternary mapping of the Grand Bend area was completed in 1974. The Parkhill area has been mapped north of a line drawn through Nairn, Crathie, Arkona and Thedford. Brief reconnaissance was carried out in the Strathroy and Perch areas (to the south and west).

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

GENERAL GEOLOGY: The area is underlain by limestones, sandstones, and shales of Devonian age (Hewitt and Liberty 1972). No bedrock is exposed in the Grand Bend area; the entire area is underlain by the limestones of the Dundee Formation (Middle Devonian). Farther south, in the Parkhill area, the Hamilton (Middle Devonian) and Kettle Point (Upper Devonian) Formations are present. The Hamilton Formation is exposed in the lower Ausable River valley in the area between Arkona and Thedford.

The most dominant feature of the area, the Wyoming Moraine, was formed during the Port Huron stadial and is composed of clayey silt till (St. Joseph Till, Cooper and Clue In Press). The St. Joseph Till comprises the surface till throughout the area except for a narrow strip along the eastern margin of the map-area. On this eastern edge, a gritty silt to clayey silt till, which includes the Seaforth Moraine till, is exposed. This till is believed to have been deposited during the Port Bruce stadial (Karrow and Apon 1974) and it extends eastwards as far as the Thames River (Karrow and Apon 1974). At Thedford, a sandy silt till with moderate stone content is exposed below the St. Joseph Till and lies directly on bedrock. A till with similar field characteristics is exposed in two localities near the Town of Brinsley, north of Ailsa Craig.

Outwash deposits of sand and gravel are found in various places in the Ausable River valley. In the Grand Bend area outwash generally takes the form of gravelly sand, but in the Parkhill area, the outwash tends to be sandy gravel.

Several well developed shorelines, which are the products of proglacial lakes, are evident in the area. The oldest shoreline is preserved as a strip of sand and gravel and a small ridge slightly east of the Ausable River between Highway 83 and Centralia. This shoreline has been referred to as the Lake Whittlesey shoreline by Terasmae et al. (1972). A well developed ridge and gravelly sand deposit extends from Blake on the northern edge of the Grand Bend area, south, through Dashwood and Mount Carmel, until southeast of Parkhill it turns west and crosses the Ausable River and extends west towards Forest. This feature represents the shoreline of proglacial Lake Warren (Terasmae et al. 1972). In several areas this shoreline shows multiple strand lines. The youngest proglacial shoreline sediments are found in the region between Thedford and Grand Bend, known as the Thedford Embayment. There are two large features, believed to represent bars, and a weakly developed shorebluff in the embayment, all of which are close to 605 feet a.s.l. (184.4 m). In view of water levels postulated for proglacial lakes in the Huron Basin (Hough 1963), Lake Algonquin or Lake Nipissing could have formed these shoreline features. These features may represent both lake stages. A very poorly developed secondary ridge, several feet below the main shoreline on the east side of the embayment appears to represent a return of the water level of approximately 605 feet (184.4 m). Lake Algonquin may have occupied the more distinct shoreline, and Lake Nipissing may have reoccupied approximately the same shoreline: a very slight isostatic rebound between times of the two lakes would result in the

observed twinning of the shoreline. If this explanation is correct, the eastern bar may have been deposited during Algonquin time, and the western bar during Nipissing time. Sedimentary structures in both features are typical of bars, and the paleocurrent direction, as indicated by bedding, is from the north to the south in both places. Extensive eolian sand deposits were derived from the westernmost bar during Nipissing and post-Nipissing time. Post-Nipissing lacustrine and organic deposits have filled the embayment. Studies on organic remains within the embayment sediments, and shells from beaches, bars, and alluvial deposits, graded to the 605 foot (184.4 m) level may clarify the history of the area.

Lacustrine sand, silt, and clay sediments, derived from local ponding, as well as Lakes Algonquin, Nipissing, and Warren have been mapped throughout the area. Organic peat and muck deposits have been mapped in several low lying areas, noteably in the Thedford Marsh area, where the peat is as thick as 3 metres (10 feet).

ECONOMIC GEOLOGY: Devonian shale of the Hamilton Formation (Arkona Member) is presently excavated near Arkona and at Thedford for the manufacture of drainage tile. The shale has also been used for the manufacture of bricks.

Numerous oil and natural gas wells have been drilled in the area, and oil is presently being extracted from a small field near Greenway, north of Parkhill.

Gravel resources in the Grand Bend-Parkhill area are sufficient to meet most local demands. Gravel has been extracted from the Warren and Whittlesey beach deposits but these sources are mainly sand, and to a large extent are depleted. Small deposits of outwash sand and gravel in the Ausable River valley have been used locally. The largest available gravel source in the area is the bay mouth bar complex in the Thedford Embayment area, but at present this deposit is not being mined extensively. All the gravels in the area suffer from a high and variable chert content (0-20 percent, average 6.5 percent).

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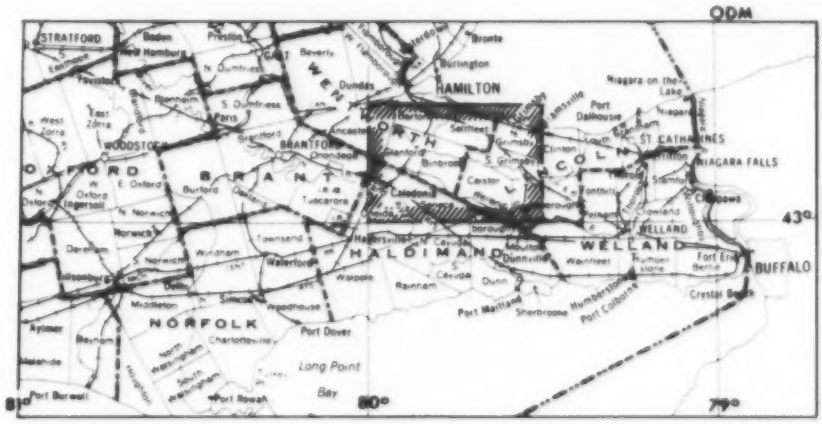
No.36 QUATERNARY GEOLOGY OF THE GRIMSBY AREA SOUTHERN ONTARIO

by

B.H. Feenstra[1]

LOCATION: The Grimsby map-area is bounded by Latitudes 43°00'N and 43°15'N or Lake Ontario, and by Longitudes 79°30'W and 80°00'W (NTS 30M/4). It includes the southern part of the City of Hamilton and mainly the area to its south and southeast between the Towns of Caledonia, Smithville, and Grimsby.



LOCATION MAP Scale: 1 inch to 25 miles

GENERAL GEOLOGY: The Niagara Escarpment crosses the northern part of the area from Grimsby and vicinity in a generally west direction for a distance of 30 miles (48 km) to Ancaster. The following Paleozoic bedrock formations, in descending order, are generally exposed along its upper part: Lockport (cap-rock), DeCew, Rochester (intermittently), Irondequoit, Reynales, Thorold, and Grimsby (upper part). The lower part of the escarpment is mantled by talus and relatively thick Halton Till.

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

The bluff along the shoreline of Lake Ontario consists predominantly of Halton Till, however, it also exposes the underlying Queenston red shale at Grimsby and the overlying sand, silt, and clay deposits of proglacial lake Iroquois near Grimsby Beach.

The abandoned shoreline of proglacial lake Iroquois follows the base of the Niagara Escarpment or forms a bluff composed of Halton Till; significant beach deposits (gravel, sand) occur only as bars across re-entrants in the escarpment. The terrace of proglacial lake Iroquois is mainly underlain by Queenston red shale and Halton Till. Its relatively thicker fine sand deposits were found in Hamilton and in the vicinity of Grimsby. Finer material (clay, silt) was deposited north of Stoney Creek.

The surficial material of the re-entrants in the Niagara Escarpment consists predominantly of Halton Till.

The portion of the map-area south of the Niagara Escarpment is mainly covered by glaciolacustrine clay and silt (proglacial Lake Warren) overlying Halton or Wentworth Till. Bedrock (Goat Island, Eramosa, and Guelph dolostone) crops out frequently in a 2 to 6 mile (3 to 10 km) wide belt along the top of the escarpment, and the Eramosa and Guelph dolostones form distinct subsidiary scarps. Dolostone of the Salina Formation is exposed along the Grand River near York and Caledonia.

Halton Till is exposed in the Vinemount and Niagara Falls moraines, but it is generally covered by glaciolacustrine clay and silt in the Fort Erie moraine further to the south. The buried margin of this till occurs beyond the latter moraine and up to 2 miles (3 km) south to southwest of the Welland River.

Wentworth Till is exposed only in numerous drumlins in the southern part of the map-area.

Shallow-water, glaciolacustrine-deltaic sands form a depositional scarp and comprise the surficial material in the area to the northwest of Hamilton Airport.

The study of the Quaternary sequence in the map-area was advanced by the results of exploratory drilling by the Geological Survey of Canada (Project 730029, Urban Geology of Hamilton).

ECONOMIC GEOLOGY: The Eramosa dolostone is quarried for road construction, asphalt concrete, and concrete aggregate at the Vinemount quarry of Armstrong Brothers Company Limited, 1½ miles (2.4 km) southeast of Vinemount, and at the quarry of A. Cope and Sons Limited located south of Stoney Creek and the Niagara Escarpment, and west of Highway 20. Gypsum (Salina Formation) is mined at Caledonia by Domtar Construction Materials Limited for the production of various types of board.

Sand and gravel are extracted from shallow-water, glaciolacustrine-deltaic deposits near Ancaster, and from ice-contact deposits south of Caledonia. These resources are quite limited in the map-area and mainly used locally in road and sewer construction.

No.37 PALEOZOIC GEOLOGY OF THE FORT ERIE, WELLAND, AND DUNNVILLE AREAS SOUTHERN ONTARIO

by

P.G. Telford[1]

LOCATION: During the summer of 19?4 geological mapping of Paleozoic rocks was completed for the Fort Erie, Welland, and Dunnville map-areas (NTS 30L/15W, 30L/14, 30L/13). The mapped region is bounded by Latitude 43°00'N, Longitude

LOCATION MAP

Scale: 1 inch to 25 miles

80°00'W, and Lake Erie and Niagara River in the south and east respectively.

GENERAL GEOLOGY: Outcrops of Paleozoic rocks are relatively sparse in this region due to a mantle, of varying thickness, of Quaternary glacial and lacustrine sediments (Feenstra 1972; 1973). The majority of outcrops are concentrated along or near the Lake Erie shoreline although many former exposures described by Best (1953) are now obscured by the present high lake level. The partly buried Onondaga Escarpment, composed of dolostones of the Bertie Formation (see below), extends approximately east-west across the mapped region and affords numerous good exposures. Several operating and abandoned quarries also provide excellent exposures.

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The lithostratigraphic sequence, with approximate ages of the individual units, is listed below (in descending order):

MIDDLE DEVONIAN

DUNDEE FORMATION

ONONDAGA FORMATION
Moorehouse Member
Clarence Member
Edgecliff Member

minor disconformity

LOWER DEVONIAN

BOIS BLANC FORMATION
Springvale Sandstone Member

minor disconformity

LOWER DEVONIAN

ORISKANY FORMATION

major disconformity

UPPER SILURIAN

BERTIE FORMATION

SALINA FORMATION

The Salina Formation, consisting of easily weathered argillaceous dolostone, shale, and evaporites, is poorly exposed; one good outcrop was examined in a railway and road cutting beneath the new Welland Canal, south of the City of Welland. More resistant dolostones of the Bertie Formation produce the relatively prominent Onondaga Escarpment with up to 50 feet (15 m) of relief. The uppermost part of the Bertie Formation in the Welland and Fort Erie map-areas is a massive, brown and cream mottled dolostone; in the Dunnville map-area this rock-unit is overlapped by a light brown, uniformly textured, blocky weathering dolostone.

The Oriskany Formation is restricted to the northwest part of the Dunnville map-area, between Nelles Corners and Clanbrassil. It disconformably overlies the Bertie Formation and is composed of massive, white to grey, friable, fossiliferous, quartzose sandstone. Elsewhere the Bertie is disconformably overlain by the Bois Blanc Formation. This unit consists mainly of grey, argillaceous, fossiliferous, cherty limestone with minor dolostone in the basal part. Forming the base of the unit at some localities is a glauconitic sandstone, the Springvale Sandstone Member, which was probably derived from reworked sand of the Oriskany Formation.

Overlying the Bois Blanc Formation is the Middle Devonian Onondaga Formation. Formerly, this part of the sequence has been referred to the Bois Blanc Formation (Best 1953) or Amherstburg Formation (Sanford 1969). The boundary between the Bois Blanc and Onondaga cannot always be located precisely. However, sampling for conodonts has been performed throughout the Bois Blanc and lower part of the Onondaga and these microfossils should aid in accurate definition of the boundary and the age difference between the two formations. In the Fort Erie, Welland, and eastern half of the Dunnville map-areas, the Onondaga can be subdivided into three lithological units or members (see above list). Farther west the subdivisions are less clear, mainly due to lack of adequate exposures. The lower or Edgecliff Member is a medium-bedded, irregularly cherty, very fossiliferous, occasionally very argillaceous limestone. Bioherms and coralline reefal bodies are common, particularly in the Port Colborne and Ridgeway area. The middle or Clarence Member consists of massive, very cherty, poorly fossiliferous to nonfossiliferous limestone. The upper or Moorehouse Member is a medium-bedded, moderately cherty, very fossiliferous limestone but it lacks large biohermal and reefal structures. Corals and crinoids are the most abundant fossils in the Edgecliff and Moorehouse Members; brachiopods, trilobites, bryozoans, and gastropods are also common. Fragmentary fish remains were discovered in an argillaceous portion of the Edgecliff Member near Port Colborne.

The uppermost Paleozoic unit in the mapped region, the Dundee Formation, is a medium-bedded, grey-brown, poorly fossiliferous, weakly cherty limestone with abundant shale partings. Several feet of black, bituminous shale form the lower part of the unit.

ECONOMIC GEOLOGY: Six major quarries are presently operated in the mapped region. These include the quarries of:

George C. Campbell Company Limited, Stevensville

Ridgemount Quarries Limited, Stevensville

Port Colborne Quarries Limited, Humberstone

R.E. Law Crushed Stone Limited, Port Colborne

Dunnville Rock Products Limited, Byng

Cayuga Materials and Construction Company Limited, Decewsville.

The main products of these operations are aggregates for asphalt and concrete production and road construction materials. Dolostones of the Bertie Formation are most suitable and this unit is worked in all quarries. The cherty Devonian limestones are useful as road construction materials but are avoided in manufacture of concrete aggregate, and only one company (Ridgemount Quarries Limited) makes extensive use of them. Oriskany sandstone is excavated by Cayuga Materials and Construction Company Limited in a small pit north of the main quarry, and is sold for use in cement production.

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OUTLINE OF AGGREGATE RESOURCE SURVEYS, 1974

by

J.Z. Fraser[1]

During the 1974 field season, numerous aggregate resource surveys were conducted by J.Z. Fraser outlining the production potential of sand, gravel, and quarry stone resources in the respective areas. Aggregate resource reports were completed for the following areas in the Province of Ontario:

South Leeds Planning Area

Township of London

Hamilton-Wentworth Planning Area

Northumberland County

Caledon Township

The Regional Municipality of Durham

The Prescott-Russell Area

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Mineral Deposits Section

SUMMARY OF ACTIVITIES OF THE MINERAL DEPOSITS SECTION, 1974

by

J.A. Robertson[1]

During 1974 the Mineral Deposits Section completed its first full year of operations and passed from the recruitment and orientation stage to a functional role.

The unit comprises one section chief, five mineral deposits geologists, and temporary staff comprising geologist's winter and summer assistants. Twenty projects, some of which are completed or nearing completion, were initiated.

These cover mineral deposit classification and distribution, mineral potential and resource analysis (e.g. by commodity or by area), and research with metallogenetic concepts and comparative studies of ore-deposits. In these studies, emphasis is placed on geological environment, development of guidelines for exploration, and input to regional government planning in such sectors as land-use planning and transportation corridors.

The Mineral Map of Ontario (scale 1 inch to 25 miles), has been completely revised and is in its final stage prior to publication. Metal distribution maps for uranium, iron, and nickel have been completed and work is continued in the corresponding maps for gold, and copper-lead-zinc.

Preliminary studies have been made on uranium, zinc and iron resources. Qualitative and quantitative mineral potential studies have been used in land-use and transportation corridor planning and a 1 inch to 16 mile scale, mineral potential map of the Province is under preparation to be followed by a series 1 inch to 4 mile scale, mineral capability maps to be used in second level regional planning.

The second and final volume of a Mineral Resource Circular, "Gold Deposits of Ontario", has been completed in manuscript and will be placed on open file pending editing and formal publication.

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